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10 UNITED STATES DISTRICT COURT
11 NORTHERN DISTRICT OF CALIFORNIA
12 SAN FRANCISCO DIVISION
13

14 MARK L. MCHUGH, an individual,

15 Plaintiff,

16 v.

17 HILLERICH & BRADSBY CO., a private
company,

18 Defendant.
19

20 AND RELATED COUNTERCLAIMS.
21
22
23
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27
28

CASE NO. C 07-03677 JSW

**DECLARATION OF CHRISTOPHER P.
GREWE IN SUPPORT OF PLAINTIFF
MARK L. MCHUGH'S OPENING
CLAIM CONSTRUCTION BRIEF
EVIDENCE**

Date: August 26, 2008
Time: 2 p.m.
Judge: Hon. Jeffrey S. White
Courtroom: Courtroom 2, 17th Floor

EXHIBIT 1

1 I, the undersigned, CHRISTOPHER GREWE, declare as follows:

2 1. I am an attorney admitted to practice before all of the courts of the State of
3 California and before the United States District Court for the Northern District of California. I am
4 an associate with the firm of Carr & Ferrell LLP, the attorneys of record for Plaintiff Mark L.
5 McHugh ("McHugh"). I make this declaration in support of McHugh's Evidence in support of
6 McHugh's Opening Claim Construction Brief ("McHugh's Evidence"). I am one of the attorneys
7 responsible for representing McHugh in this action, and the facts set out herein are within my
8 personal knowledge, or are based on documents in my possession and other information to which I
9 have access in the course of my duties. If called upon to do so I could and would testify to the truth
10 thereof.

11 2. Attached as Exhibit 2 to McHugh's Evidence is a true and correct copy of excerpts
12 from the *American Heritage Dictionary* (4th ed. 2000), *New Oxford American Dictionary of*
13 *English* (2nd ed. 2005), and the *Webster's Third New International Dictionary, Unabridged*,
14 Merriam-Webster (2002).

15 3. Attached as Exhibit 3 to McHugh's Evidence is a true and correct copy of excerpts
16 from the *American Heritage Dictionary* (4th ed. 2000), *New Oxford American Dictionary of*
17 *English* (2nd ed. 2005), and the *Webster's Third New International Dictionary, Unabridged*,
18 Merriam-Webster (2002).

19 4. Attached as Exhibit 4 to McHugh's Evidence is a true and correct copy of excerpts
20 from the *American Heritage Dictionary* (4th ed. 2000), *New Oxford American Dictionary of*
21 *English* (2nd ed. 2005), the *Webster's Third New International Dictionary, Unabridged*, Merriam-
22 Webster (2002), and *Webster's Third New International Dictionary, Unabridged*, Merriam-Webster
23 (2002).

24 5. Attached as Exhibit 5 to McHugh's Evidence is a true and correct copy of the
25 following: Dolye MD. Anatomy of the finger flexor tendon sheath and pulley system. J. HAND
26 SURG. 1988; 13A:473-484.

27 6. Attached as Exhibit 6 to McHugh's Evidence is a true and correct copy of the
28 following: FRANK H. NETTER MD., ATLAS OF THE HUMAN ANATOMY 459, 463 (Saunders Elsevier

1 4th ed. 2006) (1989).

2 7. Attached as Exhibit 7 to McHugh's Evidence is a true and correct copy of the
3 following: KEITH L. MOORE, PHD, FIAC, FRSM & ANNE M.R. AGUR, BSc(OT), MSc PHD,
4 ESSENTIAL CLINICAL ANATOMY 470 (Lipponcott Williams & Wilkins 3d ed. 2007) (1995).

5 8. Attached as Exhibit 8 to McHugh's Evidence is a true and correct copy of U.S.
6 Patent No. 5,806,091.

7 9. Attached as Exhibit 9 to McHugh's Evidence is a true and correct copy of the
8 Amendment After Final Rejection from the U.S. Patent No. 5,806,091 File Wrapper, dated August
9 19, 1997.

10 10. Attached as Exhibit 10 to McHugh's Evidence is a true and correct copy of the
11 Amendment after Non-Final Rejection from the U.S. Patent No. 5,806,091 File Wrapper, dated
12 June 12, 1996.

13 11. Attached as Exhibit 11 to McHugh's Evidence is a true and correct copy of the
14 Examiner Interview Summary Record from the U.S. Patent No. 5,806,091 File Wrapper, dated
15 August 12, 1997.

16 12. Attached as Exhibit 12 to McHugh's Evidence is a true and correct copy of the
17 Preliminary Amendment to Continued Prosecution Application from the U.S. Patent No. 5,806,091
18 File Wrapper, dated December 1, 1997.

19 13. Attached as Exhibit 13 to McHugh's Evidence is a true and correct copy of the
20 Affidavit Under Rule 132 from the U.S. Patent No. 6,389,601 File Wrapper, dated January 7, 2004.

21 I declare under penalty of perjury that the foregoing is true and correct.

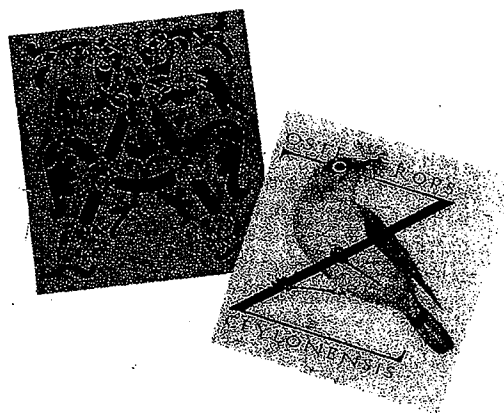
22
23 Executed: July 10, 2008

/s/ Christopher P. Grewe

Christopher P. Grewe

The
**American
Heritage[®] Dictionary**
of the English Language

FOURTH EDITION



HOUGHTON MIFFLIN COMPANY
Boston New York

EXHIBIT 2

ad feminam | adjunct

private or intimate nature. ♦ *adv.* Privately with only two individuals involved: *dining à deux*. [French : à, by, at + *deux*, two.]

fem·i·nam (ād fēm'i-nām', -nām) *adj.* Appealing to irrelevant considerations concerning women, especially prejudices against n. See Usage Note at **ad hominem**. [Latin *ad*, to + *feminam*, accusative of *fēmina*, woman.] —**ad fem'i·nam' adv.**

H *abbr.* antidiuretic hormone

HD *abbr.* attention deficit hyperactivity disorder

here (ād-hīr') *v.* **hered**, **hering**, **heres** —*intr.* 1. To stick by or as if by suction or glue. 2. To remain devoted to or be in support of something: *adhered to her beliefs*. 3. To carry out a plan, scheme, operation without deviation: *We will adhere to our plan*. —*tr.* To cause to adhere; make stick. [French *adhérer*, from Latin *adhaerere*, to stick to: *ad-* + *haerere*, to stick.]

herence (ād-hīr'ēns, -hēr'-) *n.* 1. The process or condition of being. 2. Faithful attachment; devotion: *Adherence to the rule of law is a very important principle* (William H. Webster).

herent (ād-hīr'ēnt, -hēr'-) *n.* A supporter, as of a cause or in law: *a vote that pleased adherents of education reform*. ♦ *adj.* 1. Inherent or holding fast. 2. Botany Joined but not united. Used of disjunct parts or organs. —**adher'ent·ly adv.**

hesion (ād-hē'zhən) *n.* 1. The act or state of adhering. 2. Attention or devotion; loyalty. 3. Assent or agreement to join. 4. *Medi-* a. A condition in which bodily tissues that are normally separate together. b. A fibrous band of scar tissue that binds together non-separate anatomical structures. 5. *Physics* The physical attraction of two substances, especially the macroscopically observable attraction of dissimilar substances. [French *adhésion*, from Latin *adhaesio*, from *adhaes*, past participle of *adhaerere*, to adhere. See **RE**.]

he·si·ot·o·my (ād-hē'zē-ōt'ō-mē) *n., pl. -mies* Surgical division or separation of adhesions.

hesive (ād-hē'siv, -zīv) *adj.* 1. Tending to adhere; sticky. 2. Med so as to adhere. 3. Tending to persist; difficult if not impossible to get off: *He feels an adhesive dread, a sudden acquaintance with the arker side of mankind* (George F. Will). ♦ *n.* A substance, such as cement, that provides or promotes adhesion. —**adhe'sive·ly** —**ad·he'sive·ness n.**

esive tape *n.* A tape lined on one side with an adhesive.

ad hoc (ād hōk', hōk') *adv.* For the specific purpose, case, or situation and for no other: *a committee formed ad hoc to address the issues*. ♦ *adj.* 1. Formed for or concerned with one specific purpose: *ad hoc compensation committee*. 2. *Imvised and often impromptu: in ad hoc basis, Congress has . . . placed . . . ceilings on military aid to countries* (New York Times). [Latin : *ad*, to + *hoc*, neuter accusative of *hic*, this.]

ad hoc·ism (ād hōk'iz-əm, hō'kiz-) *n.* The tendency to establish temporary, chiefly improvisational policies and procedures to deal with specific problems and tasks: *In the absence of specific guidance by specialists, ad hocism took root* (U.S. News & World Report).

ad hominem (hōm'ə-nēm', -nēm) *adj.* Appealing to personal considerations rather than to logic or reason: *Debaters should avoid ad hominem arguments that question their opponents' motives*. [Latin : *ad*, to + *hominem*, accusative of *hōmō*, man.] —**ad hom'i·nem' adv.**

e Note As the principal meaning of the preposition *ad* suggests, *ad hominem* was originally the person to whom an argument addressed, not its subject. The phrase denoted an argument designed to appeal to the listener's emotions rather than to reason, as in the sentence: *The Republicans' evocation of pity for the small farmer struggling to retain his property is a purely ad hominem argument for reducing income taxes*. This usage appears to be waning; only 37 percent of the Panel finds this sentence acceptable. The phrase now chiefly denotes an argument based on the failings of an adversary rather than on merits of the case: *Ad hominem attacks on one's opponent are a tried-and-true strategy for people who have a case that is weak*. Ninety percent of the Panel finds this sentence acceptable. The expression now also has use in referring to any personal attack, whether or not it is part of an argument, as in *It isn't in the best interests of the nation for the press to attack him in this personal, ad hominem way*. This use is acceptable to 90 percent of the Panel. • *Ad hominem* has also recently acquired a use denoting personal attacks, as in *"Notwithstanding all the ad hominem, Gingrich insists that he and Panetta can work together"* (Washington Post). This usage may raise some eyebrows, though it appears to be ingrained in journalistic style. • A modern coinage patterned on *ad hominem* is *ad feminam*, as in *"Its treatment of Nabokov and its ad feminam attack on his wife Vera often border on character assassination"* (Karlinsky). Though some would argue that this neologism is unnecessary because the Latin word *homo* refers to humans generically, rather than to the male sex, in some contexts *ad feminam* has a more specific meaning than *ad hominem*, being used to describe attacks on women or because they are women, as in *"Their recourse . . . to ad feminam attacks evidences the chilly climate for women's leadership positions"* (Donna M. Riley).

adiabatic (ād'i-ē-ā-bāt'ik, ā'di-ē-) *adj.* Of, relating to, or being a thermodynamic process that occurs without gain or loss of heat without a change in entropy. [From Greek *adiabatos*, impassible, not; see **A-1** + *diabatos*, passable (*dia-*, *dia-* + *batos*, passable, *inein*, to go; see **GWA-** in Appendix I).] —**adiabatic·ly**

adieu (ə-dyōō', ə-dōō') *interj.* Used to express farewell. ♦ *n., pl. adieus* or **adieux** (ə-dyōōz', ə-dōōz') A farewell. [Middle English, from Old French *à dieu*, (I commend you) to God : *a*, to (from Latin *ad*; see **AD-**) + *Dieu*, God (from Latin *deus*; see **DYEU-** in Appendix I).]

Adige (ā'di-jā', ā'dē-jē') A river of northeast Italy rising in the Alps and flowing about 410 km (255 mi) generally south then east to the Adriatic Sea at the Gulf of Venice.

ad infinitum (ād in'fā-nī'təm) *adv. & adj.* To infinity; having no end. [Latin *ad*, to + *infinitum*, accusative of *infinitus*, infinite.]

ad interim (in'tar-əm) *adv.* In or for the meantime; temporarily. ♦ *adj.* Acting or done ad interim; temporary. See synonyms at **temporary**. [Latin *ad*, to, for + *interim*, the meantime.]

adiós (ā'dē-ōs') *interj.* Used to express farewell. [Spanish *adiós*, probably translated from French *à dieu*. See **ADIEU**.]

adipic acid (ə-dīp'ik) *n.* A white crystalline dicarboxylic acid, C₆H₁₀O₄, that is derived from oxidation of various fats, slightly soluble in water and soluble in alcohol and acetone, and used especially in the manufacture of nylon and polyurethane foams. [From Latin *adeps*, *adip-*, fat.]

adipocere (ād'ə-pō-sēr') *n.* A brown, fatty, waxlike substance that forms on dead animal tissues in response to moisture. [ADIP(ose) + Latin *cera*, wax.]

adipocyte (ād'ə-pō-sīt') *n.* See **fat cell**.

adipose (ād'ə-pōs') *adj.* Of, relating to, or composed of animal fat; fatty. ♦ *n.* The fat found in adipose tissue. [New Latin *adiposus*, from Latin *adeps*, *adip-*, fat.] —**adipose·ness**, **adipos'ity** (pōs'itē) *n.*

adipose tissue *n.* A type of connective tissue that contains stored cellular fat.

Adirondack chair (ād'ə-rōn'dāk') *n.* An outdoor armchair having an angled back and seat made of wide, usually wooden slats.

Adirondack Mountains A group of mountains in northeast New York between the St. Lawrence River valley in the north and the Mohawk River valley in the south. The range is part of the Appalachian system and rises to 1,629.9 m (5,344 ft). Lakes, forests, and numerous winter sports resorts, including Lake Placid, site of the 1932 and 1984 Winter Olympics, attract many tourists.

adit (ād'it) *n.* An almost horizontal entrance to a mine. [Latin *aditus*, access, from past participle of *adire*, to approach : *ad-*, *ad-* + *ire*, to go; see **EI-** in Appendix I.]

adj. *abbr.* 1. adjective 2. adjunct 3. *Adj.* adjutant

adjacent (ə-jā'sən-sē) *n., pl. -cies* 1. The state of being adjacent; contiguity. 2. A thing that is adjacent.

adjacent (ə-jā'sant) *adj.* 1. Close to; lying near: *adjacent cities*. 2. Next to; adjoining: *adjacent garden plots*. [Middle English, from Latin *adiacens*, *adiacent-*, present participle of *adiacere*, to lie near : *ad-*, *ad-* + *iacerē*, to lie; see **YE-** in Appendix I.] —**adjacent·ly adv.**

adjacent angle *n.* Either of two angles having a common side and a common vertex.

adjec·ti·val (āj'tik-tī-vəl) *adj.* Of, relating to, or functioning as an adjective. —**ad·jec'ti·val·ly adv.**

adjective (āj'tik-tiv) *n.* *Abbr.* *a.* or *adj.* 1. The part of speech that modifies a noun or other substantive by limiting, qualifying, or specifying and distinguished in English morphologically by one of several suffixes, such as *-able*, *-ous*, *-er*, and *-est*, or syntactically by position directly preceding a noun or nominal phrase. 2. Any of the words belonging to this part of speech, such as *white* in the phrase *a white house*. ♦ *adj.* 1. Adjectival: *an adjective clause*. 2. Law Prescriptive; remedial: *adjective law*. 3. Not standing alone; derivative or dependent. [Middle English, from Old French *adjectif*, from Late Latin *adiectivus*, from *adiectus*, past participle of *adiacere*, to add to : *ad-*, *ad-* + *iacerē*, to throw; see **YE-** in Appendix I.] —**ad·jec'tive·ly adv.**

adjective pronoun *n.* A pronoun acting as an adjective, such as *which* in *which dictionaries?*

adjoin (ə-join') *v.* **joined**, **joining**, **joins** —*tr.* 1. To be next to; be contiguous to: *property that adjoins ours*. 2. To attach: *"I do adjoint a copy of the letter that I have received"* (John Fowles). —*intr.* To be contiguous. [Middle English *ajoinen*, from Old French *ajoinere*, *ajoin-*, from Latin *adiungere*, to join to : *ad-*, *ad-* + *iungere*, to join; see **YEUG-** in Appendix I.]

adjoining (ə-join'ing) *adj.* Neighboring; contiguous.

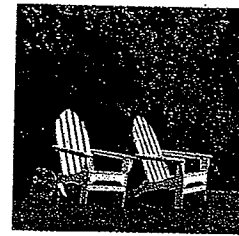
ad·journ (ə-jūrn') *v.* **journe**, **journing**, **journs** —*tr.* To suspend until a later stated time. —*intr.* 1. To suspend proceedings to another time or place. 2. To move from one place to another: *After the meal we adjourned to the living room*. [Middle English *ajournen*, from Old French *ajourner* : *a-*, to (from Latin *ad*; see **AD-**) + *jour*, day (from Late Latin *diurnum*, from Latin *diurnus*, daily, from *diēs*, day; see **DYEU-** in Appendix I).] —**ad·journ'ment n.**

Adj. *abbr.* adjutant

adjudge (ə-jūj') *tr.v.* **judged**, **judg·ing**, **judg·es** 1a. To determine or decide by judicial procedure; adjudicate. b. To order judicially; rule. c. To award (damages, for example) by law. 2. To regard, consider, or deem: *was adjudged incompetent*. [Middle English *ajugen*, from Old French *ajuger*, from Latin *adiudicare*. See **ADJUDICATE**.]

adju·di·cate (ə-jū'di-kāt') *v.* **-cat·ed**, **-cat·ing**, **-cates** —*tr.* 1. To hear and settle (a case) by judicial procedure. 2. To study and settle (a dispute or conflict): *The principal adjudicated our quarrel*. —*intr.* To act as a judge. [Latin *adiudicare*, *adiudicār-*, to award to (judicially) : *ad-*, *ad-* + *iudicare*, to judge (from *iudex*, judge; see **JUDGE**).] —**adju'di·ca'tion n.** —**adju'di·ca'tive adj.** —**adju'di·ca'tor n.**

ad·junct (āj'jŭŋkt') *n.* 1. Something attached to another in a depen-

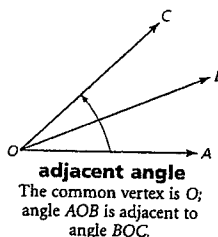


Adirondack chair



adit

Bureka Mine, Death Valley, California



ā pat	oi boy
ā pay	ou out
ār care	ōō took
ā father	ōō boot
ē pet	ū cut
ē be	ūr urge
ī pit	th thin
ī pie	th this
īr pier	hw which
ō pot	zh vision
ō toe	ə about, item
ō paw	♦ regionalism

Stress marks: ' (primary); ' (secondary), as in dictionary (dik'shə-nēr'ē)

The New Oxford American Dictionary

SECOND EDITION

FIRST EDITION

Elizabeth J. Jewell
Frank Abate

SECOND EDITION

Erin McKean

OXFORD
UNIVERSITY PRESS

2005

adjacent

20

Admiralty Islands

ad-ja-cent /əˈjæsjənt/ *adj.* 1 next to or adjoining something else: *adjacent rooms* | the area adjacent to the fire station. 2 Geometry (of angles) having a common vertex and a common side. ▶late Middle English: from Latin *adjacent-* 'lying near to', from *adjacere*, from *ad-* 'to' + *jacere* 'lie down.' —**ad-ja-cent**-cy *n.*

ad-jec-tive /əˈdʒektɪv/ *n.* Grammar a word or phrase naming an attribute, added to or grammatically related to a noun to modify or describe it. ▶late Middle English: from Old French *adjectif*, *ive*, from Latin *adject-* 'added,' from the verb *adjicere*, from *ad-* 'toward' + *jacere* 'throw.' The term was originally used in the phrase noun adjective, translating Latin *nomen adjectivum*, the latter being a translation of Greek *onoma epitheton* 'attributive name.' —**ad-jec-ti-val** /əˈdʒektɪvəl/ *adj.* —**ad-jec-ti-val-ly** /əˈdʒektɪvəlɪ/ *adv.*

ad-join /əˈdʒɔɪn/ *v.* [trans.] be next to and joined with (a building, room, or piece of land): the dining room adjoins a small library | [as *adj.*] (adjoining) adjoining room. ▶Middle English: from Old French *adjoindre*, from Latin *adjungere*, from *ad-* 'to' + *jungere* 'to join.'

ad-joint /əˈdʒɔɪnt/ *Mathematics* *adj.* relating to or denoting a function or quantity related to a given function or quantity by a particular process of transposition. ■ denoting a matrix that is the transpose of the cofactors of a given square matrix.

▶*n.* an adjoint matrix, function, or quantity. ▶late 19th cent.: from French, literally 'joined to,' from *adjoindre* (see **ADJOIN**).

ad-journ /əˈdʒɔːrn/ *v.* [trans.] (usu. be adjourned) break off (a meeting, legal case, or game) with the intention of resuming it later: the meeting was adjourned until December 4 [intrans.] let's adjourn and reconvene at 2 o'clock. See note at **POSTPONE**. ■ [intrans.] (of people who are together) go somewhere else, typically for refreshment: they adjourned to a local bar. ■ put off or postpone (a resolution or sentence): the sentence was adjourned. ▶Middle English (in the sense 'summon someone to appear on a particular day'): from Old French *ajourner*, from the phrase *a jour (nome)* 'to an (appointed) day.' —**ad-journ-ment** *n.*

ad-judge /əˈdʒʌdʒ/ *v.* [trans.] (usu. be adjudged) consider or declare to be true or the case: she was adjudged guilty | [trans.] he was adjudged to be offensive. ■ (ad-judge something to) (in legal use) award something judicially to (someone): the court adjudged legal damages to her. ■ [trans.] (in legal use) condemn (someone) to pay a penalty: the defaulter was adjudged to pay the whole amount. ▶late Middle English: from Old French *ajuger*, from Latin *adjudicare*, from *ad-* 'to' + *judicare*, from *judex*, *judic-* 'a judge.' —**ad-judg-ment** (also **ad-judge-ment**) *n.*

ad-ju-di-cate /əˈdʒʊdiːkət/ *v.* [intrans.] make a formal judgment or decision about a problem or disputed matter: the committee adjudicates on all betting disputes | [trans.] the case was adjudicated in the Supreme Court. ■ act as a judge in a competition: we asked him to adjudicate at the local flower show. ■ [trans.] pronounce or declare judicially: he was adjudicated bankrupt. ▶early 18th cent. (in the sense 'award judicially'): from Latin *adjudicatus* 'awarded judicially,' from the verb *adjudicare* (see **ADJUDGE**). The noun *adjudication* /əˈdʒʊdiːkəˈʃən/ *n.* —**ad-ju-di-ca-tive** /-kətɪv/ *adj.* —**ad-ju-di-ca-tor** /-kətər/ *n.*

ad-junct /əˈdʒʌŋkt/ *n.* 1 a thing added to something else as a supplementary rather than an essential part: computer technology is an adjunct to learning. ■ a person who is another's assistant or subordinate. 2 Grammar a word or phrase used to amplify or modify the meaning of another word or words in a sentence.

▶*adj.* [attrib.] connected or added to something, typically in an auxiliary way: other alternative or adjunct therapies include immunotherapy. ■ (of an academic post) attached to the staff of a university in a temporary or assistant capacity: an adjunct professor of entomology. [as *n.*] both adjuncts and tenured professors tend to inflate grades. ▶early 16th cent. (as an adjective meaning 'joined on, subordinate'): from Latin *adjunctus*, past participle of *adjungere* (see **ADJOIN**). —**ad-junc-tive** /əˈdʒʌŋktɪv/ *adj.*

ad-junc-tion /əˈdʒʌŋk(t)ʃən/ *n.* 1 Mathematics the joining of two sets that without overlapping jointly constitute a larger set, or the relation between two such sets. 2 Logic the asserting in a single formula of two previously asserted formulae. ▶late 16th cent.: from Latin *adjunctio(n)-*, from the verb *adjungere* (see **ADJOIN**).

ad-ju-re /əˈdʒʊr/ *v.* [trans.] formal urge or request (someone) solemnly or earnestly to do something:

I adjure you to tell me the truth. ▶late Middle English (in the sense 'put a person on oath'): from Latin *adjurare*, from *ad-* 'to' + *jurare* 'swear' (from *jus*, *jur-* 'oath'). —**ad-ju-ra-tion** /əˈdʒʊrəˈʃən/ *n.* —**ad-ju-ra-to-ry** /-tɔːrɪ/ *adj.*

ad-just /əˈdʒʌst/ *v.* 1 [trans.] alter or move (something) slightly in order to achieve the desired fit, appearance, or result: he smoothed his hair and adjusted his tie | the interest rate should be adjusted for inflation. ■ [intrans.] permit small alterations or movements so as to allow a desired fit, appearance, or result to be achieved: a harness that adjusts to the correct fit. ■ [intrans.] adapt or become used to a new situation: she must be allowed to grieve and to adjust in her own way | his eyes had adjusted to semidarkness. 2 [trans.] assess (loss or damages) when settling an insurance claim. ▶early 17th cent. (in the senses 'harmonize discrepancies' and 'assess (loss or damages)'): from obsolete French *adjuster*, from Old French *ajuster* 'to approximate,' based on Latin *ad-* 'to' + *juxta* 'near.' —**ad-just-a-ble**-ty /əˈdʒʌstəˈbɪlɪti/ *n.* —**ad-just-a-ble** *adj.* —**ad-just-er** *n.* —**ad-just-ment** *n.*

adjustable rate mortgage (abbr.: **ARM**) *n.* a mortgage whose rate of interest is adjusted periodically to reflect market conditions. Also called **VARIABLE RATE MORTGAGE**.

ad-ju-tant /əˈdʒʌtənt/ *n.* 1 a military officer who acts as an administrative assistant to a senior officer. ■ a person's assistant or deputy. 2 (also **adjutant stork** or **adjutant bird**) a large black-and-white stork with a massive bill and a bare head and neck, found in India and Southeast Asia. ■ Genus *Leptoptilos*, family Ciconiidae: two species. ▶early 17th cent. (in the sense 'assistant, helper'): from Latin *adjutant-* 'being of service to,' from *adjutare*, frequentative of *adjuvare* 'assist' (see **ADJUVANT**). —**ad-ju-tan-cy** *n.*

ad-ju-tant general *n.* (pl. **ad-ju-tants general**) the adjutant of a unit having a general staff. ■ (the **Adjutant General**) (in the U.S. Army) the chief administrative officer. ■ the senior officer in the National Guard of a U.S. state.

ad-ju-vant /əˈdʒʌvənt/ *adj.* Medicine (of therapy) applied after initial treatment for cancer, esp. to suppress secondary tumor formation.

▶*n.* Medicine a substance that enhances the body's immune response to an antigen. ▶late 16th cent.: from Latin *adjuvans* 'helping toward,' from the verb *adjuvare*, from *ad-* 'toward' + *juvare* 'to help.'

Ad-ler /ˈædlər; ˈæd-, ˈæd-/ (1870–1937), Austrian psychologist and psychiatrist. Adler disagreed with Freud's idea that mental illness was caused by sexual conflicts in infancy, arguing that society and culture were significant factors. He introduced the concept of the inferiority complex. —**Ad-ler-i-an** /ˈædlər-i-ən; ˈæd-, ˈæd-/ *adj.* & *n.*

ad lib /ˈæd ˈlɪb/ *v.* (ad libbed, ad lib-bing) [intrans.] speak or perform in public without previously preparing one's words: Charles had to ad lib because he'd forgotten his script | [trans.] she ad libbed half the speech.

▶*n.* something spoken or performed in such a way: he came up with an apt ad lib.

▶*adv.* & *adj.* 1 spoken or performed without previous preparation: an ad lib commentary | [as *adv.*] speaking ad lib. 2 as much and as often as desired: [as *adv.*] the price includes meals and drinks ad lib | [as *adj.*] the pigs are fed on an ad lib system. 3 Music (in directions) in an improvised manner with freedom to vary tempo and instrumentation. ▶early 19th cent. (as an *adv.*): abbreviation of **AD LIBITUM**.

ad lib-i-tum /ˈæd ˈlɪbɪtəm/ *adv.* & *adj.* more formal term for **AD LIB** (sense 2). ▶early 17th cent.: Latin, literally 'according to pleasure.'

ad li-tem /ˈæd ˈlɪtəm/ *adj.* Law (esp. of a guardian) appointed to act in a lawsuit on behalf of a child or other person who is not considered capable of representing themselves. ▶mid 18th cent.: Latin, literally 'for the lawsuit.'

ad loc. ▶abbr. to or at that place.

Adm. ▶abbr. **Admiral**.

ad-man /ˈæd,mən/ *n.* (pl. *-men*) informal a person who works in advertising.

ad-min /ˈæd,mɪn/ *n.* informal the administration of a business, organization, etc.: [as *adj.*] admin staff. ▶1940s: abbreviation.

ad-min-is-ter /ˈædˈmɪnəstər/ *v.* [trans.] 1 manage and be responsible for the running of (a business, organization, etc.): each school was administered separately. ■ be responsible for the implementation or use of (law or resources): a federal agency would administer new regulations. 2 dispense or apply (a remedy or drug): paramedic crews are capable of administering

drugs. ■ deal out or inflict (punishment): retribution was administered to those found guilty. ■ (of a priest) perform the rites of (a sacrament, typically the Eucharist). ■ archaic or Law direct the taking of (an oath): the chief justice will administer the oath of office. 3 [intrans.] give help or service: we must selflessly administer to his needs. ▶late Middle English: via Old French from Latin *administrare*, from *ad-* 'to' + *ministrare* (see **MINISTER**). —**ad-min-is-tra-ble** /-strəbəl/ *adj.* **ad-min-is-trate** /ˈædˈmɪnəˌstræt/ *v.* [trans.] less common term for **ADMINISTER** (sense 1). ▶mid 16th cent.: from Latin *administrat-* 'managed,' from the verb *administrare* (see **ADMINISTER**).

ad-min-is-tra-tion /ˈædˈmɪnəˌstræʃən/ (abbr.: **admin.**) *n.* 1 the process or activity of running a business, organization, etc.: the day-to-day administration of the company | a career in arts administration | [as *adj.*] administration costs. ■ (the administration) the people responsible for this, regarded collectively: the university administration took their demands seriously. ■ the management of public affairs; government: the inhabitants of the island voted to remain under French administration. ■ Law the management and disposal of the property of an intestate, deceased person, debtor, or other individual, or of an insolvent company, by a legally appointed administrator: the company went into administration | [as *adj.*] an administration order. 2 the officials in the executive branch of government under a particular chief executive: the Bush Administration's demand that the missiles be removed. ■ the term of office of a political leader or government: the early years of the Reagan Administration. ■ a government agency: the U.S. Food and Drug Administration. 3 the action of dispensing, giving, or applying something: the oral administration of the antibiotic | the administration of justice. ▶Middle English: from Latin *administratio(n)-*, from the verb *administrare* (see **ADMINISTER**).

ad-min-is-tra-tive /ˈædˈmɪniˌstrətɪv; -strətɪv/ *adj.* of or relating to the running of a business, organization, etc.: administrative problems | administrative staff. ▶mid 18th cent.: from Latin *administrativus*, from *administrat-* 'managed,' from the verb *administrare* (see **ADMINISTRATE**). —**ad-min-is-tra-tive-ly** *adv.*

ad-min-is-tra-tive law *n.* Law legislative requirements, typically for businesses, issued by government agencies in published regulations.

ad-min-is-tra-tor /ˈædˈmɪnəˌstrətər/ *n.* a person responsible for running a business, organization, etc. ■ Law a person legally appointed to manage and dispose of the estate of an intestate, deceased person, debtor, or other individual, or of an insolvent company. ■ a person who performs official duties in some sphere, esp. dealing out punishment or giving a religious sacrament: administrators of justice.

ad-min-is-tra-trix /ˈædˈmɪnəˌstrætɪks/ *n.* Law a female administrator of an estate.

ad-mira-ble /ˈædmərəbəl/ *adj.* arousing or deserving respect and approval: he has one admirable quality—he is totally honest | what is admirable in one sex is disdained in the other. ▶late Middle English: via Old French from Latin *admirabilis* 'to be wondered at,' from *admirari* (see **ADMIRE**). —**ad-mira-bly** /-blɪ/ *adv.*

ad-mi-ral /ˈædmərəl/ *n.* 1 a commander of a fleet or naval squadron, or a naval officer of very high rank. ■ a commissioned officer of very high rank in the U.S. Navy or Coast Guard, ranking above a vice admiral. ■ short for **VICE ADMIRAL** or **REAR ADMIRAL**. 2 [with *adj.*] a butterfly that has dark wings with bold colorful markings. ■ Several species in the subfamilies Limenitidinae and Nymphalidae, family Nymphalidae. See **RED ADMIRAL**, **WHITE ADMIRAL**. ▶Middle English (denoting an emir or Saracen commander): from Old French *amiral*, *admiral*, via medieval Latin from Arabic *ʿamir* 'commander' (from *ʾamarā* 'to command'). The ending *-al* was from Arabic *-al-* in the sense 'of the' used in forming titles (e.g., *ʿamir-al-ʿumaraʾ* 'ruler of rulers'), later assimilated to the familiar Latinate suffix *-AL*. —**ad-mi-ral-ship** /-ʃɪp/ *n.*

Ad-mi-ral of the Fleet *n.* the highest rank of admiral in the Royal Navy. Compare with **FLEET ADMIRAL**.

ad-mi-ral-ty /ˈædmərəlɪti/ *n.* (pl. *-ties*) 1 the rank or office of an admiral. 2 Law the jurisdiction of courts of law over cases concerning ships or the sea and other navigable waters (maritime law). 3 (**Admiralty**) the department of the British government that once administered the Royal Navy. ▶late Middle English: from Old French *admiralte*, from *admirail* 'emir, leader' (see **ADMIRAL**).

Ad-mi-ral-ty Is-lands /ˈædmərəlɪti/ a group of about 40 islands in the western Pacific, part of Papua New

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ing of connective tissue with the cells disintegrated by droplets of
ad-ī-po-sis \əd'pōsəz/ *n*, *pl* adipose-ses \-v.səz/ [NL, fr.
adip- + -osis] 1: ADIPOSITY, OBESITY 2: the condition of
adip- + -itis] or degeneration of single organs (as the
heart or liver)
adipositis do-lō-ro-sa \-dōlə'rōsə/ *n* [NL, lit., painful adipo-
sis]: a condition of generalized obesity characterized by
pain in the abnormal deposits of fat
ad-ī-po-si-ty \əd'pōsəd-ē/ *n* -ES: the quality or state of
being fat 2: OBESITY
ad-ī-po-sus-gen-i-tal dysphro-sia \əd'pōsə'jenəd-'V-/ *n* [adipo-
se + -o + genital]: a combination of obesity, retarded
development of the sex glands, and changes in secondary sex
characteristics that results from impaired function or disease
of the pituitary body and hypothalamus—called also
Fröhlich's syndrome
ad-ī-pu-s \əd'pūz/, -wīl, -a-/ *n* -O(-)C(=O)CH₂CO- of adipic acid
ad-ī-rōn-dack \əd'ran'dak/ *n*, *pl* adiron-dack or adiron-
dacks usu cap [Mohawk, *Hatirōntak*, lit., they eat trees]
1: the Algonkian people formerly north of the St. Lawrence
river 2: a member of the Adirondack people
adiron-dack blackly *n*, usu cap A a common blackfly
(*Prosimulium hirtipes*) widespread in eastern No. America
adiron-dack chair *n*, often cap A [prob. so called fr. its popular
wooden slant-back, low, open chair seat, of
which usu, is higher at the front than at the
back]
ad-it \əd'ət/ *n* -[L *aditus* approach, en-
trance, fr. *aditus*, past part. of *adire* to
go to, approach, fr. *ad-* + *ire* to go—more
at ISSUE] 1: a nearly horizontal opening
by which a mine or Adirondack resort or
tunnel—called also *tunnel*; compare DRIFT 6,
GALLERY, INCLINE, LEVEL, SHAFT 2; the
act of coming to: APPROACH, ADMISSION, ACCESS (gain ~
to the throne)
ad-iti-o \əd'ish-ō/ *n* -[L, fr. L, approach, fr. *aditus* (past
part.) + -io -ion] Roman law: the informal acceptance by
an outsider of heirship; broadly: the vesting of the inheritance
into a testate or intestate estate or the entering into
the inheritance
ad-i-tus \əd'əd-əs/ *n*, *pl* aditus or adituses [L]: a passage
or opening for entrance
adive \əd'ev/ *n* -[S [F]: CORSAC
ad-ī-abb-r 1 adjacent 2 adjective 3 adjourned 4 adjured
5 adjunct 6 adjustable; adjusted; adjustment 7 often cap
adjutant
ad-ī-jab-ī \əd'jəb-'i/ *n* -[prob. native name in Africa]: NIAVE
ad-ī-jace-ent \əd'jās-'n-, -sī/ *n* -[ML *adjacentia*]: ADJACENCY 2
ad-ī-jace-ny \əd'jās-'ni/ *n* -[ML *adjacentia*, fr. LL, state of
being adjacent, fr. L *adjacent-*, *adjacens* + -ia -y] a: what-
ever is adjacent in space b: nearby or neighboring places
—usu. pl. 2 [LL]: the quality or state of being adjacent
—CONTIGUITY 3: a radio or television program or announce-
ment immediately following or preceding (his 9:30 program
was immediately preceding his 10:00 program)
adjacency effect *n*: a change in size, density, or other prop-
erty of a photographic image sometimes observed when small
adjacent images are close enough to influence each other and
when such a change is not to be expected from the normal
sensitometric properties of the material—compare BORDER
EFFECT, EBBERHARD EFFECT, MACKIE LINE
ad-ī-jac-ent \əd'jās-'n-/, -sī/ *n* -[L, MF, fr. L *adjacent-*,
adjacens, pres. part. of *adjacere* to be near, border on, on
ad- + *jacere* to lie, fr. *jacere* to throw—more at JET (to
spout)] 1: a: not distant or far off (the city square and the
streets): nearby but not touching (the islands and the
mainland coast) b: relatively near and having nothing
of the same kind intervening: having a common border
2: ABUTTING, TOUCHING, ADJACENT, ADJACENT, ADJACENT
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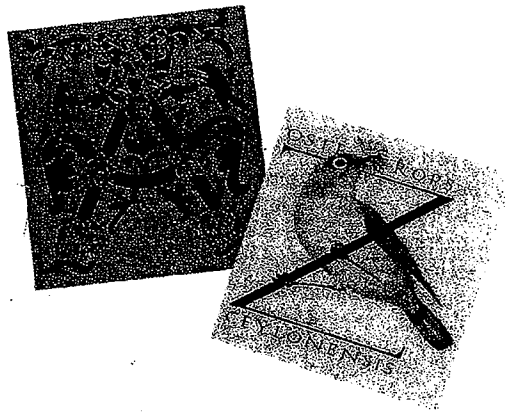


EXHIBIT 3



HOUGHTON MIFFLIN COMPANY
Boston New York

residuary | resonant

re·sid·u·ary (ri-zij'ō-ēr'ē) *adj.* 1. Of, relating to, or constituting a residue. 2. Law Entitled to the residue of an estate.

re·sid·ue (rēz'z-dōō', -dyōō') *n.* 1. The remainder of something after removal of parts or a part. 2. Matter remaining after completion of an abstract chemical or physical process, such as evaporation, combustion, distillation, or filtration; residuum. 3. Law The remainder of a testator's estate after all claims, debts, and bequests are satisfied. Also called *residuum*. [Middle English, from Old French *residu*, from Latin *residuum*, *residuus*, remaining, from *residēre*, to remain behind. See *RESIDE*.]

re·sid·u·um (ri-zij'ō-əm) *n., pl. -u·a* (-ō-ə) 1. Something remaining after removal of a part; a residue. 2. Law See *residue* (sense 3). [Latin, residue. See *RESIDUE*.]

re·sign (ri-zin') *v.* -signed, -signing, -signs —*tr.* 1. To submit (oneself) passively; accept as inevitable: *I resigned myself to a long wait in line.* 2. To give up (a position, for example), especially by formal notification. 3. To relinquish (a privilege, right, or claim). See synonyms at *relinquish*. —*intr.* To give up one's job or office; quit, especially by formal notification: *resign from a board of directors.* [Middle English *resignen*, from Old French *resigner*, from Latin *resignāre*, to unseal: *re-*, + *signāre*, to seal (from *signum*, mark, seal; see *sek*^{W.1} in Appendix I.)] —**re·sign'er** *n.*

re·sign (rē-sin') *tr.v.* -signed, -signing, -signs To sign again: *re-signed the lease.*

re·sig·na·tion (rēz'ig-nā'shən) *n.* 1. The act or an instance of resigning. 2. An oral or written statement that one is resigning a position or an office. 3. Unresisting acceptance of something as inescapable; submission. See synonyms at *patience*.

re·signed (ri-zind') *adj.* Feeling or marked by resignation; acquiescent: *"I like trees because they seem more resigned to the way they have to live than other things do"* (Willa Cather). —**re·sign'ed·ly** (-zī'nd-lē) *adv.* —**re·sign'ed·ness** *n.*

re·sile (ri-zil') *intr.v.* -siled, -siling, -siles 1. To spring back, especially to resume a former position or structure after being stretched or compressed. 2. To draw back; recoil. [Obsolete French *resilir*, from Latin *resilire*, to leap back: *re-*, + *salire*, to leap; see *sel-* in Appendix I.]

re·sil·ience (ri-zil'yəns) *n.* 1. The ability to recover quickly from illness, change, or misfortune; buoyancy. 2. The property of a material that enables it to resume its original shape or position after being bent, stretched, or compressed; elasticity.

re·sil·ien·cy (ri-zil'yən-sē) *n.* Resilience.

re·sil·ient (ri-zil'yant) *adj.* 1. Marked by the ability to recover readily, as from misfortune. 2. Capable of returning to an original shape or position, as after having been compressed. See synonyms at *flexible*. [Latin *resiliēns*, *resiliens*, present participle of *resilire*, to leap back. See *RESILE*.] —**re·sil'ient·ly** *adv.*

re·sili·n (rēz'z-lin) *n.* An elastic substance consisting of cross-linked protein chains, found in the cuticles of many insects. [*RESILE* + *-IN*.]

re·sin (rēz'in) *n.* 1. Any of numerous clear to translucent yellow or brown, solid or semisolid, viscous substances of plant origin, such as copal, rosin, and amber, used principally in lacquers, varnishes, inks, adhesives, synthetic plastics, and pharmaceuticals. 2. Any of numerous physically similar polymerized synthetics or chemically modified natural resins including thermoplastic materials such as polyvinyl, polystyrene, and polyethylene and thermosetting materials such as polyesters, epoxies, and silicones that are used with fillers, stabilizers, pigments, and other components to form plastics. —*tr.v.* -ined, -ining, -ines To treat or rub with resin. [Middle English, from Old French *resine*, from Latin *resina*, from Greek dialectal **rhēsinā*, variant of Greek *rhētīnē*.] —**res'in·ous** (rēz'z-ōs) *adj.*

re·sin·ate (rēz'z-nāt') *tr.v.* -at·ed, -at·ing, -ates To impregnate, permeate, or flavor with resin.

resin canal *n.* An intercellular tube lined with resin-secreting cells, found in the wood and leaves of many gymnosperms. Also called *resin duct*.

re·sin·if·er·ous (rēz'z-nif'ər-əs) *adj.* Yielding resin.

re·sin·oid (rēz'z-noid') *adj.* Relating to, resembling, or containing resin. —*n.* A synthetic resin, especially a thermosetting resin.

re·sist (ri-zist') *v.* -sist·ed, -sist·ing, -sists —*tr.* 1. To strive to fend off or offset the actions, effects, or force of. 2. To remain firm against the actions, effects, or force of; withstand: *a bacterium that resisted the antibiotic.* 3. To keep from giving in to or enjoying. —*intr.* To offer resistance. See synonyms at *oppose*. —*n.* A substance that can cover and protect a surface, as from corrosion. [Middle English *resisten*, from Old French *resister*, from Latin *resistere*: *re-*, + *sistere*, to place; see *stā-* in Appendix I.] —**re·sist'er** *n.*

re·sis·tance (ri-zis'təns) *n.* 1. The act or an instance of resisting or the capacity to resist. 2. A force that tends to oppose or retard motion. 3. often *Resistance* An underground organization engaged in a struggle for national liberation in a country under military or totalitarian occupation. 4. *Psychology* A process in which the ego opposes the conscious recall of anxiety-producing experiences. 5. *Biology* a. The capacity of an organism to defend itself against a disease. b. The capacity of an organism or a tissue to withstand the effects of a harmful environmental agent. 6. *Electricity* The opposition of a body or substance to current passing through it, resulting in a change of electrical energy into heat or another form of energy. —**re·sis'tant** *adj.*

resistance factor *n.* See *R factor*.

resistance plasmid *n.* See *R factor*.

Re·sis·ten·cia (rēs'j-stēn'sē-ə, rēs'sēs-tēn'syā) A city of northeast Argentina on the Paraná River opposite Corrientes. It is a major trade and shipping center. Population: 228,199.

re·sist·i·ble (ri-zis'tə-bəl) *adj.* Possible to resist: *resistible impulses.* —**re·sist'ibil'i·ty** *n.* —**re·sist'ibly** *adv.*

re·sist·ive (ri-zis'tiv) *adj.* Of, tending toward, or marked by resistance: *a person resistive to change.* —**re·sist'ive·ly** *adv.* —**re·sist'ive·ness** *n.*

re·sist·iv·ity (rēz'z-tiv'i-tē) *n., pl. -ties* 1. The capacity for or tendency toward resistance. 2. *Electricity* An intrinsic property of a material that is measured as its resistance to current per unit length for a uniform cross section.

re·sist·less (ri-zis'tlis) *adj.* 1. Impossible to resist; irresistible: *resistless force; resistless love.* 2. Powerless to resist; unresisting. —**re·sist'less·ly** *adv.* —**re·sist'less·ness** *n.*

re·sist·or (ri-zis'tər) *n.* A device used to control current in an electric circuit by providing resistance.

Re·și·ta (rē'shē-tsā') A city of western Romania in the western Transylvanian Alps west-northwest of Bucharest. It has an important iron and steel industry. Population: 110,300.

res ju·di·ca·ta (rēz' jōō'di-kā'tā, rās') also **res ad·ju·di·ca·ta** (ə-jōō'-) *n.* An adjudicated issue that cannot be relitigated. [Latin *res iudicata*, thing decided: *res*, thing + *iudicāta*, feminine past participle of *iudicare*, to judge.]

re·sole (rē-sōl') *tr.v.* -soled, -solving, -soles To put a new sole on (a shoe).

re·sol·u·ble (ri-zōl'yə-bəl) *adj.* Possible to resolve; resolvable: *resolvable differences in opinion.* [Late Latin *resolūbilis*, from Latin *resolvere*, to resolve. See *RESOLVE*.] —**re·sol'ubil'i·ty**, **re·sol'uble·ness** *n.*

re·sol·ute (rēz'z-lōūt', rēz'z-lōūt') *adj.* Firm or determined; unwavering. [Middle English, dissolved, dissolute, from Latin *resolutus*, relaxed, past participle of *resolvere*, to relax, untie. See *RESOLVE*.] —**re·sol'ute·ly** *adv.* —**re·sol'ute·ness** *n.*

re·sol·u·tion (rēz'z-lōū'shən) *n.* 1. The state or quality of being resolute; firm determination. 2. A resolving to do something. 3. A course of action determined or decided on. 4. A formal statement of a decision or expression of opinion put before or adopted by an assembly such as the U.S. Congress. 5. *Physics & Chemistry* The act or process of separating or reducing something into its constituent parts: *the prismatic resolution of sunlight into its spectral colors.* 6. The fineness of detail that can be distinguished in an image, as on a video display terminal. 7. *Medicine* The subsiding or termination of an abnormal condition, such as a fever or an inflammation. 8. Law A court decision. 9a. An explanation, as of a problem or puzzle; a solution. b. The part of a literary work in which the complications of the plot are resolved or simplified. 10. *Music* a. The progression of a dissonant tone or chord to a consonant tone or chord. b. The tone or chord to which such a progression is made. 11. The substitution of one metrical unit for another, especially the substitution of two short syllables for one long syllable in quantitative verse.

re·solve (ri-zōlv') *v.* -solved, -solving, -solves —*tr.* 1. To make a firm decision about. 2. To cause (a person) to reach a decision. See synonyms at *decide*. 3. To decide or express by formal vote. 4. To change or convert: *My resentment resolved itself into resignation.* 5. To find a solution to; solve. See synonyms at *solve*. 6. To remove or dispel (doubts). 7. To bring to a usually successful conclusion: *resolve a conflict.* 8. *Medicine* To cause reduction of (an inflammation, for example). 9. *Music* To cause (a tone or chord) to progress from dissonance to consonance. 10. *Chemistry* To separate (an optically inactive compound or mixture) into its optically active constituents. 11. To render parts of (an image) visible and distinct. 12. *Mathematics* To separate (a vector, for example) into coordinate components. 13. To melt or dissolve (something). 14. *Archaic* To separate (something) into constituent parts. —*intr.* 1. To reach a decision or make a determination: *resolve on a course of action.* 2. To become separated or reduced to constituents. 3. *Music* To undergo resolution. —*n.* 1. Firmness of purpose; resolution. 2. A determination or decision; a fixed purpose. 3. A formal resolution made by a deliberative body. [Middle English *resolvere*, to dissolve, from Old French *resolver*, from Latin *resolvere*, to untie: *re-*, + *solvere*, to untie; see *leu-* in Appendix I.] —**re·solv'a·bil'i·ty**, **re·solv'a·ble·ness** *n.* —**re·solv'a·ble** *adj.* —**re·solv'ed·ly** (-zōl'vid-lē) *adv.* —**re·solv'er** *n.*

re·sol·vent (ri-zōl'vant) *adj.* Causing or able to cause separation into constituents; solvent. —*n.* A solvent substance, especially a medicine that reduces inflammation or swelling.

re·so·nance (rēz'z-ə-nəns) *n.* 1. The quality or condition of being resonant: *words that had resonance throughout his life.* 2. Richness or significance, especially in evoking an association or strong emotion: *"It is home and family that give resonance . . . to life"* (George Gilder). *"Israel, gateway to Mecca, is of course a land of religious resonance and geopolitical significance"* (James Wolcott). 3. *Physics* The increase in amplitude of oscillation of an electric or mechanical system exposed to a periodic force whose frequency is equal or very close to the natural undamped frequency of the system. 4. *Physics* A subatomic particle lasting too short a time to be observed directly. The existence of such particles is usually inferred from a peak in the energy distribution of its decay products. 5. *Acoustics* Intensification and prolongation of sound, especially of a musical tone, produced by sympathetic vibration. 6. *Linguistics* Intensification of vocal tones during articulation, as by the air cavities of the mouth and nasal passages. 7. *Medicine* The sound produced by diagnostic percussion of the normal chest. 8. *Chemistry* The property of a compound having simultaneously the characteristics of two or more structural forms that differ only in the distribution of electrons. Such compounds are highly stable and cannot be properly represented by a single structural formula.

re·so·nant (rēz'z-ə-nant) *adj.* 1a. Strong and deep in tone; resound-

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FIRST EDITION

Elizabeth J. Jewell
Frank Abate

SECOND EDITION

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residual stress

1441

resolve

absence of a causative agent: *residual stenosis*.
 not an experimental or arithmetical error) not ac-
 quired for or eliminated. ■ (of a soil or other de-
 posits) formed in situ by weathering.

■ quantity remaining after other things have
 been subtracted or allowed for. ■ a difference be-
 tween a value measured in a scientific experiment
 and the theoretical or true value. ■ a royalty paid to
 a performer, writer, etc., for a repeat of a play, tele-
 vision show, etc. ■ *Geology* a portion of rocky or
 soil ground remaining after erosion. ■ the resale
 value of a new car or other item at a specified time
 after purchase, expressed as a percentage of its pur-
 chase price. —*resid-u-ally* adv.

residual stress *n.* Physics the stress present in an
 object in the absence of any external load or force.
 ■ *Law* *residual* *adj.* technical residual. ■ *Law*
 relating to the residue of an estate: a *residuary*
 will. ■ early 18th cent.: from *RESIDUUM* + *-ARY*.

residue */ˈreɪz, d(ə)ʒi/ n.* a small amount of some-
 thing that remains after the main part has gone or
 been taken or used. ■ *Law* the part of an estate that
 remains after the payment of charges, debts, and be-
 neficiaries. ■ a substance that remains after a process
 such as combustion or evaporation. ▶late Middle
 English from Old French *residu*, from Latin *residuum*
 'something remaining' (see *RESIDUUM*).

residue *n.* *residue* *adj.* *residue* *n.* (pl. *-s*) *tech-*
 nical substance or thing that remains or is left be-
 hind in particular, a chemical residue. ▶late 17th
 century from Latin, neuter of *residuum* 'remaining,'
 from the verb *residere*.

resign */rɪˈzɪn/ v.* 1 *[intrans.]* voluntarily leave a job or
 position: he *resigned* from the government in
 protest at the policy. ■ *[trans.]* give up (an office, power,
 privilege, etc.): four deputies *resigned* their seats. ■ *[in-*
trans.] Chess end a game by conceding defeat with-
 out being checkmated: he lost his queen and *resigned* in
 the 12th move. 2 (be *resigned*) accept that something un-
 desirable cannot be avoided: he seems *resigned* to a
 career in teaching. ■ she *resigned* herself to a lengthy session.
 ■ he *resigned* himself to her direction. ▶late Middle Eng-
 lish from Old French *resigner*, from Latin *resignare*
 'cancel, from re- 'back' + *signare* 'sign, seal.'
 —*resigned-ly* *adv.* —*re-sign-ed-ness* *n.* —*re-sign-er* *n.*

resign */rɪˈzɪn/ v.* *[trans.]* sign (a document) again.
 ■ (a sports player) to play for a team for a fur-
 ther period. ■ *[intrans.]* (of a sports player) commit
 oneself to play for a team for a further period.

resignation */rɪˈzɪnəʃən/ n.* 1 an act of retiring
 from a position: he announced his *resignation*.
 ■ a statement conveying someone's intention of re-
 signing. ■ the act of handing in my *resignation*. ■ Chess
 conceding a game by conceding defeat with-
 out being checkmated. 2 the acceptance of some-
 thing undesirable but inevitable: a *shrug* of *resigna-*
 tion. ▶late Middle English: via Old French from
 Latin *resignatio(n)*, from *resignare* 'unseal,
 resign'.

resile */rɪˈzɪl/ v.* *[trans.]* formal abandon a position or
 action: can he *resile* from the agreement?
 ■ *[intrans.]* (of a material) to spring back: the
 metal *resiled* from the impact. ■ from obsolete French *resilire*
 'to recoil,' from re- 'back' + *salire* 'to

resilient */rɪˈzɪliənt/ adj.* (of a substance or object)
 able to spring back into shape after bend-
 ing or being compressed. See note at
 resilient. ■ (of a person or animal) able to withstand
 or recover quickly from difficult conditions: the fish
 was *resilient* to most infections. ▶mid 17th cent.: from
 Latin *resilire* 'leaping back,' from the verb *resilire*
 'leap back, recoil'.

resilience *n.* —*re-sil-i-ent-ly* *adv.* —*re-sil-i-ent-ness* *n.* —*re-sil-i-ent-ly* *adv.*
 ■ *Biochemistry* an elastic material
 that is cross-linked protein chains, found in in-
 termediate filaments, esp. in the hinges and ligaments of
 joints. ■ from Latin *resilire* 'leap back, recoil'

resin */ˈreɪzɪn/ n.* a sticky flammable organic sub-
 stance soluble in water, exuded by some trees
 and plants (notably fir and pine). Compare
 resinous. ■ (also *synthetic resin*) a solid
 synthetic organic polymer used as the
 basis of adhesives, varnishes, or other prod-

resin */ˈreɪzɪn/ v.* *[usu. as adj.]* (resined)
 coated with resin: resined canvas. ▶late Middle
 English from Latin *resina*; related to Greek *rhētine*
 'resin.' Compare with *ROSIN*. —*res-in-ous* *adj.*

res-in-ate */ˈreɪzə, nāt/ v.* *[trans.]* impregnate or flavor
 with resin: [as *adj.*] (resinated) resinated white wine.
 ■ *n.* *resenit* *n.* Chemistry a salt of an acid derived from
 resin.

res ipso lo-qui-tur */ˈrɛz, ɪpsə ˈlɒkwɪtər; ˈrās, ˈlɒkwə-
 ˈtɔːr/ n.* Law the principle that the occurrence of an
 accident implies negligence. ▶Latin, literally 'the
 matter speaks for itself.'

re-sist */rɪˈzɪst/ v.* *[trans.]* withstand the action or ef-
 fect of: antibodies help us to *resist* infection. ■ try to pre-
 vent by action or argument: we will *continue* to *resist*
 changes to the treaty. ■ succeed in ignoring the attrac-
 tion of (something wrong or unwise): she *resisted* his
 advances | I couldn't *resist* buying the blouse. ■ *[intrans.]*
 struggle against someone or something: without *giv-*
ing her time to *resist*, he dragged her off her feet.

■ a resistant substance applied as a coating to pro-
 tect a surface during some process, for example to
 prevent dye or glaze adhering. ▶late Middle Eng-
 lish: from Old French *resister* or Latin *resistere*, from
 re- (expressing opposition) + *sistere* 'stop' (redupli-
 cation of *stare* 'to stand'). The current sense of the
 noun dates from the mid 19th cent. —*re-sist-er* *n.*
 —*re-sist-ible* *adj.* —*re-sist-ibil-ity* */rɪ, zɪstəˈbɪləti/ n.*

re-sistance */rɪˈzɪstəns/ n.* 1 the refusal to accept or
 comply with something; the attempt to prevent
 something by action or argument: she *put up* no *re-*
sistance to being led away. ■ armed or violent opposi-
 tion: government forces were unable to crush guerrilla-
 style *resistance*. ■ (also *re-sistance movement*) [in
 sing.] a secret organization resisting authority, esp.
 in an occupied country. ■ (the *Resistance*) the un-
 derground movement formed in France during
 World War II to fight the German occupying forces
 and the Vichy government. Also called *MAQUIS*. ■ the
 impeding, slowing, or stopping effect exerted by
 one material thing on another: air *resistance* would
 need to be reduced by streamlining. 2 the ability not to
 be affected by something, esp. adversely: some of us
 have a lower *resistance* to cold than others. ■ *Medicine &*
Biology lack of sensitivity to a drug, insecticide, etc.,
 esp. as a result of continued exposure or genetic
 change. 3 the degree to which a substance or device
 opposes the passage of an electric current, causing
 energy dissipation. Ohm's law *resistance* (measured
 in ohms) is equal to the voltage divided by the cur-
 rent. ■ a resistor or other circuit component that
 opposes the passage of an electric current. ▶late Middle
 English: from French *résistance*, from late Latin
resistentia, from the verb *resistere* 'hold back' (see
RESIST).

■ **PHRASE** *the line (or path) of least resistance* an
 option avoiding difficulty or unpleasantness; the
 easiest course of action.

re-sist-ant */rɪˈzɪstənt/ adj.* offering resistance to
 something or someone: some of the old churches are *re-*
sistant to change | [in combination] a water-resistant ad-
 hesive.

re-sis-tive */rɪˈzɪstɪv/ adj.* technical able to withstand
 the action or effect of something. ■ *Physics* of or
 concerning electrical resistance.

re-sis-tiv-ity */rɪ, zɪstɪvɪti/ n.* *Physics* a measure of the
 resisting power of a specified material to the flow of
 an electric current.

re-sis-tless */rɪˈzɪstlɪs/ adj.* archaic powerful and ir-
 resistible: a *resistless* impulse. ■ powerless to resist the
 effect of someone or something; unresisting. —*re-*
sist-less-ly *adv.*

re-sis-tor */rɪˈzɪstər/ n.* *Physics* a device having a de-
 signed resistance to the passage of an electric cur-
 rent.

re-size */rɪˈsaɪz/ v.* *[trans.]* alter the size of (something,
 esp. a computer window or image).

res judi-ca-ta */ˈrɛz, ʃʊdɪˈkɑːtə; ˈrās/ n.* (pl. *res judi-*
ca-tae /ˈʃʊdɪˈkɑːtə; -tɪ/) Law a matter that has been ad-
 judged by a competent court and may not be pur-
 sued further by the same parties. ▶Latin, literally
 'judged matter.'

re-skin */rɪˈskɪn/ v.* (skinned, -skin-ning) *[trans.]* re-
 place or repair the skin of (an aircraft or motor ve-
 hicle).

Res-nais */rɛˈnɑː; rɛˈneɪ/*, Alain (1922–), French movie
 director. One of the foremost directors of the *nou-*
velle vague, he used experimental techniques to ex-
 plore memory and time. Notable movies: *Hiroshima*
mon amour (1959) and *L'Amour à mort* (1984).

re-sold */rɛˈsɔld/ v.* past and past participle of **RESELL**.

re-sol-u-ble */rɪˈzɒləbəl/ adj.* archaic able to be re-
 solved. Pearly 17th cent.: from French *résoluble* or
 late Latin *resolubilis*, based on Latin *solvere* 'release,
 loosen.'

re-sol-u-ble *adj.* able to dissolve or be dissolved
 again: the *resoluble* nature of the paint.

re-sol-u-tive */ˈreɪzə, lʊtɪv/ adj.* admirably purposeful,
 determined, and unwavering: she was *resolute* and
 unwavering. ▶late Middle English (in the sense 'paid,'
 describing a rent): from Latin *resolutus* 'loosened, re-
 leased, paid,' past participle of *resolvere* (see **RE-**
SOLVE). —*re-sol-u-tely* *adv.* —*re-sol-u-tive-ness* *n.*

THE RIGHT WORD constant, decisive, determined,
 faithful, resolute, staunch

Any of the above adjectives might apply to you if
 you take a stand on something and stick to it, or
 show your loyalty to a person, country, or cause.

If you show unwavering loyalty to someone or
 something you are tied to (as in marriage, friend-
 ship, etc.), you would be described as *faithful* (a
faithful wife; a *faithful Republican*).

Constant also implies a firm or steady attach-
 ment to someone or something, but with less em-
 phasis on vows, pledges, and obligations. It is the
 opposite of fickleness rather than of unfaithfulness
 (my grandfather's *constant* confidence).

To be described as *staunch* carries loyalty one
 step further, implying an unwillingness to be dis-
 tanced or turned aside (a *staunch* friend who refused to
 believe the rumors that were circulating).

To be called *resolute* means that you are both
 staunch and steadfast, but the emphasis here is on
 character and a firm adherence to your own goals
 and purposes rather than to those of others (*resolute*
 in insisting upon her right to be heard).

Determined and *decisive* are less forceful words.
 You can be *decisive* in almost any situation, as long
 as you have a choice among alternatives and don't
 hesitate in taking a stand (*decisive* as always, she turned
 around at the menu before ordering).

Determined, unlike *resolute*, suggests a stubborn
 will rather than a conscious adherence to goals or
 principles (he was *determined* to be home before the hol-
 idays).

re-sol-u-tion */ˈreɪzəˈlʊʃən/ n.* 1 a firm decision to
 do or not to do something: she kept her *resolution* not
 to see Anne any more | a New Year's *resolution*. ■ a formal
 expression of opinion or intention agreed on by a
 legislative body, committee, or other formal meet-
 ing, typically after taking a vote: the conference passed
 two *resolutions*. ■ the quality of being determined or
 resolute: he handled the last French actions of the war
 with *resolution*. See note at **COURAGE**. 2 the action of
 solving a problem, dispute, or contentious matter:
 the peaceful *resolution* of all disputes | a successful *resolu-*
tion to the problem. ■ Music the passing of a discord
 into a concord during the course of changing har-
 mony. ■ *Medicine* the disappearance of inflamma-
 tion, or of any other symptom or condition. 3
 chiefly *Chemistry* the process of reducing or sepa-
 rating something into its components. ■ *Physics* the
 replacing of a single force or other vector quantity
 by two or more jointly equivalent to it. ■ the con-
 version of something abstract into another form.
 ■ *Prosody* the substitution of two short syllables for
 one long one. 4 the smallest interval measurable by
 a scientific (esp. optical) instrument; the resolving
 power. ■ the degree of detail visible in a photo-
 graphic or television image. ▶late Middle English:
 from Latin *resolutio(n)*, from *resolvere* 'loosen, re-
 lease' (see **RESOLVE**).

re-sol-u-tive */rɛˈzɒlyutɪv; ˈreɪzəˈlʊtɪv/ adj.* formal or ar-
 chaic having the power or ability to dissolve or dis-
 pel something. ▶late Middle English: from me-
 dieval Latin *resolutivus*, from *resolut-* 'released,' from
 the verb *resolvere* (see **RESOLVE**).

re-solve */rɪˈzɒlv; ˈrɒlv/ v.* 1 *[trans.]* settle or find a so-
 lution to (a problem, dispute, or contentious mat-
 ter): the firm aims to *resolve* problems within 30 days.
 ■ *[trans.]* *Medicine* cause (a symptom or condition) to
 disperse, subside, or heal: endoscopic biliary drainage
 can rapidly *resolve* jaundice. ■ *[intrans.]* (of a symptom
 or condition) disperse, subside, or heal: symptoms *re-*
solved after a median of four weeks. ■ *[intrans.]* Music (of
 a discord) lead into a concord during the course of
 harmonic change. ■ *[trans.]* Music cause (a discord) to
 pass into a concord. 2 *[intrans.]* decide firmly on a
 course of action: [with infinitive] she *resolved* to call
 Dana as soon as she got home. ■ [with clause] (of a leg-
 islative body, committee, or other formal meeting)
 make a decision by a formal vote: the committee

Pronunciation Key *a ago; ər over; ʊ or ʌ up; ər or ər*
fur, a hat; ă rate; ă car, ch chew; e let; ē see; e(ə) air;
i fit; i by; i(ə) ear; ŋg sing; ō go; ō for; oi boy; ō good; ō
goo; ou out; sh she; th thin; th then; (h)w why; zh vision

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residual dextrin

residual dextrin *n* : LIMIT DEXTRIN
residual error *n* : the difference between a group of values observed and their arithmetical mean
residual estate *n* : RESIDUARY ESTATE
re-sid-u-al-ly *adv* = *adv* [residual + -ly] : as a residue
residual magnetism or **residual induction** *n* : magnetization remaining in a magnetized body no longer under external magnetic influence : the magnetism of a permanent magnet
residual phenomena *n pl* : the phenomena that remain to be explained after the effects of known causes are subtracted
residual placer *n* : a placer deposit consisting of decomposed rock or residual portions of such rock and lying at the locality of origin
residual power *n* : power held to remain at the disposal of a governmental authority (as an executive or the central government of a federation) after an enumeration or declaration of specific powers to other authorities (the residual power of the Dominion could not be employed ... except in the case of extraordinary natural emergency — Alexander Brady)
— compare **RESERVED POWER**
residual product *n* : BY-PRODUCT (coke and coal tar from gasworks are residual products)
residual ray *n* : any of the infrared rays that remain in a beam of radiant radiation after a series of reflections from a crystal
residual soil *n* : soil formed in situ by rock decay and left as a residue after the leaching out of the more soluble products
residual sound *n* : the sound audible in a place after the source has become silent
— compare **REVERBERATION**
residual stress *n* : a stress that exists within a solid body though no external stress-producing forces are acting and that due to some inequality of previous treatment of adjacent parts (for example annealed glass may be highly unstable because of residual stress) and shatter from a slight shock) — compare **RUPERT'S DROP**
residual valence *n* : unemployable valence; *esp* : combining power that is not utilized when the elements combine to form simple molecules and so leads to such phenomena as association and hydration — compare **HYDROGEN BOND**
residue *n* : /rɪˈzɪdʒ, wɛr, rɛz-, -jər/, *adj* [L *residuum* : residue] 1 : the part of, or relating to, consisting of, or constituting a residue, remainder, or remainder (the ~ part of an estate)
residue *n* : ~ *n* - *adj* residuary legatee
residuary clause *n* [residuary] : a clause in a will by which the residue of his estate is disposed of to one or more persons — compare **BEQUEST** 1a
residuary estate *n* : the residue of a testator's estate
residuary legacy *n* : a legacy that includes all of a testator's estate not specifically distributed in other legacies or in charges against the estate
residuary legatee *n* : a legatee inheriting a testator's residuary estate
residue *n* : /rɛzɪdʒ(ə)l/ *n* - *s* [ME, fr. MF *residu*, fr. L *residuum*, from *re-* + *sedere*, to sit, to remain, fr. *residere* to sit back, to remain, from *RESIDE*] : something that remains after a part of is taken away, removed, or designated : **REMANANT**
REMANANT, REST : as a ~ part of a testator's estate or of charges of administration, statutory satisfaction of all debts, and a widow and children, and previous devices for support of the testator
REMANANT 2b : the part of a molecule that remains after the removal of a portion of its constituents : an atom or molecule in a molecule
REMANANT 3 : the part of a molecule that remains in a fat (like stearin) (polyglycols) are based upon mal-
REMANANT 4 : like amylopectin, the branches contain less
REMANANT 5 : half as many maltose units (J.W.McBain) — compare
RESIDUAL *adj* & *n* **GROUPS**
RESIDUAL 1 : /rɛzɪdʒ(ə)l/ *n* - *s* [ME, fr. MF *residu*, fr. L *residuum* — more at **RESIDE**] : something that remains after a part of is taken away, removed, or designated : **REMANANT**
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RESIDUAL 2 : the part of a molecule that remains after the removal of a portion of its constituents : an atom or molecule in a molecule
RESIDUAL 3 : the part of a molecule that remains in a fat (like stearin) (polyglycols) are based upon mal-
RESIDUAL 4 : like amylopectin, the branches contain less
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FOURTH EDITION

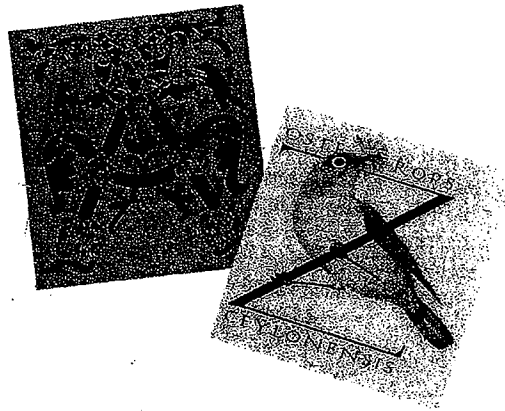


EXHIBIT 4



HOUGHTON MIFFLIN COMPANY
Boston New York

sty¹ (sti) *n., pl. sties* (stiz) 1. An enclosure for swine. 2. A filthy place. **sty** *tr. & intr.v.* **stied** (stid), **sty-ing**, **sties** (stiz) To shut up in or live in a sty. [Middle English, from Old English *stig*.]

sty² also **stye** (sti) *n., pl. sties* also **styes** (stiz) Inflammation of one or more sebaceous glands of an eyelid. [Alteration of Middle English *styan*: *styan*, *sty* (from Old English *stigend*, from present participle of *stigan*, to rise; see **steigh-** in Appendix I) + *eye*, *ye*, *eye*; see **EYE**.]

stygian also **stygian** (stijē-ən) *adj.* 1a. Gloomy and dark. b. Infernal; hellish. 2. Of or relating to the river Styx. [From Latin *Stygus*, from Greek *Stygios*, from *Styx*, *Styx*.]

styl- *pref.* Variant of **stylo-**.

stylar (stī'lār, -lār') *adj.* 1. Of, relating to, or resembling a stylus. 2. *Biology* Of or relating to a style.

stylate (stī'lāt') *adj.* Having a style or styles.

style (stil) *n.* 1. The way in which something is said, done, expressed, or performed: a style of speech and writing. 2. The combination of distinctive features of literary or artistic expression, execution, or performance characterizing a particular person, group, school, or era. 3. Sort; type: a style of furniture. 4. A quality of imagination and individuality expressed in one's actions and tastes: *does things with style*. 5a. A comfortable and elegant mode of existence: *living in style*. b. A mode of living: *the style of the very rich*. 6a. The fashion of the moment, especially of dress; vogue. b. A particular fashion: *the style of the 1920s*. See synonyms at **fashion**. 7. A customary manner of presenting printed material, including usage, punctuation, spelling, typography, and arrangement. 8. A form of address; a title. 9a. An implement used for etching or engraving. b. A slender pointed writing instrument used by the ancients on wax tablets. 10. The needle of a phonograph. 11. The gnomon of a sundial. 12. *Botany* The usually slender part of a pistil, situated between the ovary and the stigma. 13. *Zoology* A slender, tubular, or bristlelike process: a cartilaginous style. 14. *Medicine* A surgical probing instrument; a stylet. 15. *Obsolete* A pen. **tr.v.** **styled**, **styl-ing**, **styles** 1. To call or name; designate: *George VI styled his brother Duke of Windsor*. 2. To make consistent with rules of style: *style a manuscript*. 3. To give style to: *style hair*. [Middle English, from Old French, from Latin *stylus*, *stylus*, spike, pointed instrument used for writing, style. See **STYLUS**.] —**styl'er** *n.* —**styl'ing** *n.*

style-book (stī'l'bōk') *n.* A book giving rules and examples of usage, punctuation, and typography, used in preparation of copy for publication.

stylet (stī-lēt', stī-lit') *n.* 1. A slender, pointed instrument or weapon, such as a stylet. 2a. A surgical probe. b. A fine wire that is run through a catheter, cannula, or hollow needle to keep it stiff or clear of debris. 3. *Zoology* A small, stiff, needlelike organ or appendage, such as the feeding organ of a tardigrade. [French, from Italian *stiletto*, *stiletto*. See **STILETTO**.]

styli (stī'li) *n.* A plural of **stylus**.

styli- *pref.* Variant of **stylo-**.

styli-form (stī'li-fōrm') *adj.* Having the shape of a style; slender and pointed: a styli-form bone or appendage.

stylish (stī'lish) *adj.* Conforming to the current fashion; modish. See synonyms at **fashionable**. —**styl'ish-ly** *adv.* —**styl'ish-ness** *n.*

style-ist (stī'list) *n.* 1. A writer or speaker who cultivates an artful literary style. 2. A designer of or consultant on styles in decorating, dress, or beauty. 3. A hairdresser.

stylistic (stī-lis'tik) *adj.* Of or relating to style, especially literary style. —**stylis'tic-al-ly** *adv.*

stylistics (stī-lis'tiks) *n.* (used with a sing. verb) The study of the use of elements of language style, such as metaphor, in particular contexts.

stylet (stī'lit') *n.* One of a number of early Christian ascetics who lived unsheltered on the tops of high pillars. [Late Greek *stīlētēs*, from Greek *stīlos*, pillar. See **stā-** in Appendix I.] —**stylit'ic** (-lit'ik) *adj.* —**stylit'ism** (stī'lit'iz-əm) *n.*

stylet (stī'liz') *tr.v.* -ized, -iz-ing, -izes 1. To restrict or make conform to a particular style. 2. To represent conventionally; conventionalize. —**styl'iz-a'tion** (stī'li-zā'shən) *n.* —**styl'iz'er** *n.*

stylo- or **styl-** *pref.* **Style:** *stypodidum*. [From Latin *stylus*, *stylus*, stake, stem, style. See **STYLUS**.]

stylobate (stī'la-bāt') *n.* *Architecture* The immediate foundation of a row of classical columns. Also called *stereobate*. [Latin *stylobata*, from Greek *stūlobatēs*: *stūlos*, pillar; see **stā-** in Appendix I + *bainein*, to walk; see **gā-** in Appendix I.]

styloid (stī'loid') *adj.* 1. Resembling a style in shape; slender and pointed: *the styloid muscles in carnivores*. 2. *Anatomy* Of, relating to, or designating any of several slender, pointed bone processes, especially the spine that projects from the base of the temporal bone.

stylo-lite (stī'la-lit') *n.* A secondary structure found along contacting surfaces of adjacent calcareous rock layers, the contact zone appearing in cross section as a series of jagged interlocking up-and-down projections that resemble a suture or the tracing of a stylus. [Greek *stīlos*, pillar; see **STYLITE** + **-LITE**.]

stylo-podium (stī'la-pō'di-əm) *n., pl. -dia* (-dē-ə) An enlargement at the base of the style of flowers in certain plants of the parsley family.

stylus (stī'las) *n., pl. -lus-es* or **-li** (-li) 1. A sharp, pointed instrument used for writing, marking, or engraving. 2. *Computer Science* A pointed instrument used as an input device on a pressure-sensitive screen. 3. A phonograph needle. 4. A sharp, pointed tool used for cutting record grooves. [Latin, alteration (influenced by Greek *stīlos*, pillar) of *stylus*.]

sty-mie also **sty-my** (stī'mē) *tr.v.* -mied (-mēd), -mie-ing also

-my-ing (-mē-ing), **-mies** (-mēz) To thwart; stump: a problem in thermodynamics that stymied half the class. **st.** 1. An obstacle or obstruction. 2. *Sports* A situation in golf in which an opponent's ball obstructs the line of play of one's own ball on the putting green. [Origin unknown.]

stypsis (stip'sis) *n.* The action or application of a styptic. [Late Latin *stypsis*, from Greek *stūpsis*, from *stūphein*, to contract.]

styptic (stip'tik) *adj.* 1. Contracting the tissues or blood vessels; astringent. 2. Tending to check bleeding by contracting the tissues or blood vessels; hemostatic. **st.** 1. A styptic drug or substance. [Middle English *stiptik*, from Old French *stiptique*, from Latin *stypicus*, from Greek *stūptikos*, from *stūphein*, to contract.] —**styp'tic-ity** (-tis'i-tē) *n.*

styptic pencil *n.* A short medicated stick, often of alum, applied to a cut to check bleeding.

Styr (stīr) A river, about 436 km (271 mi) long, of northwest Ukraine flowing northward to the Pripyet River.

styrax (stī'raks) *n.* See **storax** (senses 2, 3). [Latin. See **STORAX**.]

styrene (stī'rēn') *n.* A colorless oily liquid, $C_6H_5CH=CH_2$, the monomer for polystyrene. [Latin *styrax*, *storax*; see **STORAX** + **-ENE**.]

Styrofoam (stī'rō-fōm') A trademark used for a light, resilient polystyrene plastic. This trademark often occurs in print in lowercase: "throw-away plates, utensils and styrofoam trays" (Washington Post).

Styron (stī'rən), **William** Born 1925. American writer primarily known for his novels, including *Lie Down in Darkness* (1951) and *The Confessions of Nat Turner* (1967).

Styx (stīks) *n.* *Greek Mythology* The river across which the souls of the dead are ferried, one of the five rivers in Hades. [Latin, from Greek *Styx*.]

suable (sū'ā-bəl) *adj.* Subject to suit in a court of law. —**su'ā-bil-ity** *n.*

suasion (swā'zhən) *n.* Persuasion: *moral suasion*. [Middle English, from Old French, from Latin *suāsio*, *suāsion-*, from *suāsus*, past participle of *suādere*, to advise. See **swād-** in Appendix I.]

suasive (swā'siv) *adj.* Having the power to persuade or convince; persuasive. [Latin *suāsus*, past participle of *suādere*, to advise; see **SUASION** + **-IVE**.] —**su'a-sive-ly** *adv.* —**su'a-sive-ness** *n.*

suave (swāv) *adj.* **suav'er**, **suav'est** Smoothly agreeable and courteous. [French, agreeable, from Old French, from Latin *suāvis*, delightful, sweet. See **swād-** in Appendix I.] —**suave-ly** *adv.* —**suave-ness**, **suav-ity** (swā'vī-tē) *n.*

sub¹ (süb) *n.* *Informal* 1. See **submarine** (sense 1). 2. See **submarine** (sense 2). See **Regional Note** at **submarine**.

sub² (süb) *Informal n.* A substitute. **intr.v.** **subbed**, **sub-bing**, **subs** To act as a substitute.

sub. *abbr.* 1. subaltern 2a. suburb b. suburban

sub- *pref.* 1. Below; under; beneath: *subsoil*. 2a. Subordinate; secondary: *subplot*. b. Subdivision: *subregion*. 3. Less than completely or normally; nearly; almost: *subhuman*. [Middle English, from Latin, from *sub*, under. See **upo** in Appendix I.]

sub-ab-dom-i-nal (süb'āb-döm'ā-nəl) *adj.* Located or occurring below the abdomen.

sub-ac-id (süb-äs'id) *adj.* Somewhat sharp or acid in character: *sub-acid remarks*.

sub-a-cute (süb'ā-kyōōt') *adj.* 1. Somewhat or moderately acute: *subacute petals and sepals*. 2. Between acute and chronic: *subacute fever symptoms*; *subacute endocarditis*. —**sub'a-cute-ly** *adv.*

subacute scler-ose-ing pan-encephalitis (sklā-rō'sīng) *n.* An often fatal degenerative disease of the central nervous system occurring chiefly in young people, caused by slow infection with a measles virus and characterized by progressive loss of mental and motor functions ending in dementia and paralysis. [*scler-ose-ing*, from *sclerose*, to harden, back-formation from **SCLEROSED**.]

sub-ad-dress (süb'ā-drēs') *n.* A section of a computer device for input and output accessible through an operation code.

sub-aer-i-al (süb-är'ē-əl) *adj.* Located or occurring on or near the surface of the earth.

sub-al-pine (süb-äl'pīn') *adj.* 1. Of or relating to regions at or near the foot of the Alps. 2. Of, relating to, inhabiting, or growing in mountainous regions just below the timberline.

sub-al-tern (süb-äl'tärn, süb'al-türn') *adj.* 1. Lower in position or rank; secondary. 2. *Chiefly British* Holding a military rank just below that of captain. 3. *Logic* In the relation of a particular proposition to a universal with the same subject, predicate, and quality. **st.** 1. A subordinate. 2. *Chiefly British* A subaltern officer. 3. *Logic* A subaltern proposition. [French *subalterne*, from Old French, from Late Latin *subalternus*: Latin *sub-*, sub- + Latin *alternus*, alternate (from *alter*, other; see **al-** in Appendix I).]

sub-al-ter-nate (süb-äl'tər-nīt) *adj.* 1. Subordinate. 2. *Botany* Arranged in an alternating pattern but tending to become opposite. Used of leaves. —**sub'al-ter-na'tion** (-nā'shən) *n.*

sub-ant-arctic (süb'ānt-ärk'tik, -är'tik) *adj.* Of or resembling regions just north of the Antarctic Circle.

sub-ap-i-cal (süb-äp'i-kəl, -äp'i-) *adj.* Located below or near an apex. —**sub-ap'i-cal-ly** *adv.*

sub-a-que-ous (süb-ä'kwē-əs, -äk'wē-) *adj.* 1. Formed or adapted for underwater use or operation; submarine. 2. Found or occurring underwater: *subaqueous organisms*; *subaqueous rocks*.

sub-a-rach-noid (süb'ä-rāk'noid) *adj.* Situated or occurring beneath the arachnoid membrane, or between the arachnoid and the pia mater: *subarachnoid space*; *subarachnoid anesthesia*.

sub-arctic (süb-ärk'tik, -är'tik) *adj.* Of or resembling regions just south of the Arctic Circle.

ā pat	oi boy
ā pay	ou out
ār care	ōō took
ā father	ōō boot
ē pet	ū cut
ē be	ūr urge
ī pit	th thin
ī pie	th this
ir pier	hw which
ō pot	zh vision
ō toe	ə about, item
ō paw	♦ regionalism

Stress marks: ' (primary);
' (secondary), as in
dictionary (dik'sha-nēr'ē)

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2005

stymie

the recorded sound for reproduction. ■ a similar point producing such a groove when recording sound. 2 an ancient writing implement, consisting of a small rod with a pointed end for scratching letters on wax-covered tablets, and a blunt end for obliterating them. ■ an implement of similar shape used esp. for engraving and tracing. ■ Computing a penlike device used to input handwritten text or drawings directly into a computer or for input on a touch-sensitive monitor. ▶early 18th cent. (as a modern Latin term in botany: see *STYLE*): erroneous spelling of Latin *stilus*.

stymie /'stīmē/ ▶ *v.* (-mies, -mied, -my-ing or -mie-ing) [trans.] informal prevent or hinder the progress of: the changes must not be allowed to stymie new medical treatments. ▶mid 19th cent. (originally a golfing term, denoting a situation on the green where a ball obstructs the shot of another player): of unknown origin.

styptic /'stiptik/ *Medicine* ▶ *adj.* (of a substance) capable of causing bleeding to stop when it is applied to a wound.

▶ *n.* a substance of this kind. ▶late Middle English: via Latin from Greek *stiptikos*, from *stuppein* 'to contract'.

styptic pen-cil ▶ *n.* a stick of a styptic substance, used to treat small cuts.

sty-rax /'stī,raks/ ▶ *n.* variant of *STORAX*.

sty-rene /'stī,rēn/ ▶ *n.* Chemistry an unsaturated liquid hydrocarbon obtained as a petroleum byproduct. It is easily polymerized and is used to make plastics and resins. • Chem. formula: $C_6H_5CH=CH_2$. ▶late 19th cent. from *STYRAX* + *-ENE*.

sty-ro-foam /'stīrə,fōm/ ▶ *n.* trademark a kind of expanded polystyrene. ▶1950s: from *POLYSTYRENE* + *FOAM*.

Styron /'stīrən/, William (Clark, Jr.) (1925–), U.S. writer. His works include *The Confessions of Nat Turner* (1967); *Sophie's Choice* (1979); *Darkness Visible* (1990), about his own battle with depression; and *A Tidewater Morning: Three Tales from Youth* (1993).

Styx /stiks/ Greek Mythology one of the rivers in the underworld, over which Charon ferried the souls of the dead. ▶from Greek *Styx*, from *stugnos* 'hateful, gloomy'.

suasion /'swāzən/ ▶ *n.* formal persuasion as opposed to force or compulsion. ▶late Middle English: from Old French, or from Latin *suasio*(-n), from *suadere* 'to urge'.

suasive /'swāsv/ ▶ *adj.* serving to persuade. ■ Grammar denoting a class of English verbs, for example, *insist*, whose meaning includes the notion of persuading and that take a subordinate clause whose verb may either be in the subjunctive or take a modal.

suave /swāv/ ▶ *adj.* (suaver, suavest) (esp. of a man) charming, confident, and elegant: all the waiters were suave and deferential. See note at *URBANE*. ▶late Middle English (in the sense 'gracious, agreeable'): from Old French, or from Latin *suavis* 'agreeable'. The current sense dates from the mid 19th cent. —*suavely* *adv.* —*suave-ness* *n.* —*suav-ity* /-tē/ (*n.* pl. -ties).

sub /səb/ *informal* ▶ *n.* 1 a submarine. ■ short for *SUBMARINE SANDWICH*. 2 a subscription. 3 a substitute. ▶ *v.* (subbed, subbing) [intrans.] act as a substitute for someone: he subbed for Scott as weatherman.

sub, *abbr.* ■ subordinated. ■ subscription. ■ substitute. ■ suburb. ■ suburban. ■ subway.

sub- ▶ *prefix* 1 at, to, or from a lower level or position: subalpine | sub-basement. ■ lower in rank: subdeacon. ■ of a smaller size; of a subordinate nature: subculture. ■ of lesser quality; inferior: subhuman | substandard. 2 somewhat; nearly; more or less: subantarctic. 3 denoting a later or secondary action of the same kind: sublet | subdivision | subsequent. 4 denoting support: subvention. 5 Chemistry in names of compounds containing a relatively small proportion of a component: suboxide. ▶from Latin *sub* 'under, close to'.

USE & SUB: is also found assimilated in the following forms: *suc-* before *t*; *suf-* before *f*; *sug-* before *g*; *sub-* before *p*; *sur-* before *r*; *sus-* before *s*; *sub-* before *b*.

sub-acid /səb,'æsɪd/ ▶ *adj.* (of a fruit) moderately sharp to the taste. ▶mid 17th cent.: from Latin *subacidus* (see *SUB-*, *ACID*).

sub-acute /səb,'kyʊt/ ▶ *adj.* 1 Medicine (of a condition) between acute and chronic. 2 moderately acute in shape or angle.

sub-adult /səb,'dʌlt/ ▶ *n.* Zoology an animal that is not fully adult.

sub-aerial /səb,'eɪəriəl/ ▶ *adj.* Geology existing, occurring, or formed in the open air or on the earth's surface, not underwater or underground. —*sub-aerially* *adv.*

sub-a-gen-cy /səb,'æjənsə/ ▶ *n.* (pl. -cies) a subordinate commercial, political, or other agency. —*sub-agent* /-jənt/ *n.*

sub-al-pine /səb,'alpi:n/ ▶ *adj.* of or situated on the higher slopes of mountains just below the treeline.

sub-al-tern ▶ *n.* /səb,'ɒltərn/ an officer in the British army below the rank of captain, esp. a second lieutenant.

▶ *adj.* /səb,'ɒltərn/ 1 of lower status: the private tutor was a recognized subaltern part of the bourgeois family. 2 /səb,'ɒltərn/ dated Logic (of a proposition) implied by another proposition (e.g., as a particular affirmative is by a universal one), but not implying it in return. ▶late 16th cent. (as an adjective): from late Latin *subalternus*, from Latin *sub-* 'below' + *alternus* 'every other'.

sub-ant-arctic /səb,'ænt,'ɑːktɪk/ ▶ *adj.* of or relating to the region immediately north of the Antarctic Circle.

sub-a-quatic /səb,'kwætɪk/ ▶ *adj.* underwater: a narrow, subaquatic microclimate.

sub-a-que-ous /səb,'akwēəs/ ▶ *adj.* existing, formed, or taking place underwater. ■ figurative lacking in substance or strength: the light that filtered through the leaves was pale, subaqueous.

sub-a-rach-noid /səb,'ræknɔɪd/ ▶ *adj.* Anatomy denoting or occurring in the fluid-filled space around the brain between the arachnoid membrane and the pia mater, through which major blood vessels pass.

sub-arctic /səb,'ɑːktɪk/ ▶ *adj.* of or relating to the region immediately south of the Arctic Circle.

sub-as-sem-bly /səb,'sɛmblē/ ▶ *n.* (pl. -blies) a unit assembled separately but designed to be incorporated with other units into a larger manufactured product.

Sub-At-lan-tic ▶ *adj.* Geology of, relating to, or denoting the fifth climatic stage of the postglacial period in northern Europe, following the Sub-Boreal stage (from about 2,800 years ago to the present day). The climate has been cooler and wetter than in the earlier postglacial periods. ■ [as *n.*] (the Sub-Atlantic) the Sub-Atlantic climatic stage.

sub-a-tom-ic /səb,'təmk/ ▶ *adj.* smaller than or occurring within an atom.

sub-a-tom-ic par-ti-cle ▶ *n.* a particle smaller than an atom (e.g., a neutron) or a cluster of such particles (e.g., an alpha particle). Compare with *ELEMENTARY PARTICLE*.

sub-au-dition /səb,'dɪʃən/ ▶ *n.* a thing that is not stated, only implied or inferred. ▶late 18th cent.: from late Latin *subauditiō*(-n), from *subaudire* 'understand'.

sub-base-ment ▶ *n.* a story below a basement.

Sub-Bo-re-al ▶ *adj.* Geology of, relating to, or denoting the fourth climatic stage of the postglacial period in northern Europe, between the Atlantic and Sub-Atlantic stages (about 5,000 to 2,800 years ago). The stage corresponds to the Neolithic period and Bronze Age, and the climate was cooler and drier than previously but still warmer than today. ■ [as *n.*] (the Sub-Boreal) the Sub-Boreal climatic stage.

sub-branch ▶ *n.* a secondary or subordinate branch of anything that has branches, such as a tree, a subject of study, or a bank.

sub-breed ▶ *n.* a minor variant of a breed; a secondary breed.

sub-car-rier /səb,'kærɪə/ ▶ *n.* Telecommunications a carrier wave modulated by a signal wave and then used with other subcarriers to modulate the main carrier wave.

sub-cate-go-ry /səb,'kætə,gōrɪ/ ▶ *n.* (pl. -ries) a secondary or subordinate category. —*sub-cate-go-ri-za-tion* /səb,'kætə,gōrɪ,'zæʃən/ *n.* —*sub-cate-go-rize* /səb,'kætə,gōrɪ,'zɪz/ *v.*

sub-class /səb,'klɑːs/ ▶ *n.* a secondary or subordinate class. ■ Biology a taxonomic category that ranks below class and above order.

sub-cla-vi-an /səb,'klævɪən/ ▶ *adj.* Anatomy relating to or denoting an artery or vein that serves the neck and arm on the left or right side of the body. ▶mid 17th cent.: from modern Latin *subclavius*, from *sub* 'under' + *clavis* 'key' (see *CLAVICLE*), + *-IAN*.

sub-clin-ical /səb,'klɪnɪkəl/ ▶ *adj.* Medicine relating to or denoting a disease that is not severe enough to present definite or readily observable symptoms.

sub-com-mit-tee /səb,'kɒmɪtɪ/ ▶ *n.* a committee

composed of some members of a larger committee board, or other body and reporting to it.

sub-com-pact /səb,'kɒmpækt/ ▶ *n.* a motor vehicle that is smaller than a compact.

sub-con-i-cal /səb,'kɒnɪkəl/ ▶ *adj.* approximately conical.

sub-con-scious /səb,'kɒnʃəs/ ▶ *adj.* of or concerning the part of the mind of which one is not fully aware but which influences one's actions and feelings. —*subconsciously* *adv.*

▶ *n.* (one's/the subconscious) this part of the mind (not in technical use in psychoanalysis, where *unconscious* is preferred). —*subconsciously* *adv.* —*sub-conscious-ness* *n.*

sub-con-ti-nent /səb,'kɒntɪnənt/ ▶ *n.* a large, distinguishable part of a continent, such as North America or southern Africa. See also *INDIAN SUBCONTINENT*. —*sub-con-ti-nen-tal* /-kɒntɪnən(t)l/ *adj.*

sub-con-tract ▶ *v.* /səb'kɒn'trækt/ [trans.] to hire a business or person outside one's company to do part of a larger project: we would subcontract the translation work out. ■ [intrans.] (of a business or person) carry out work for a company as part of a larger project.

▶ *n.* /səb,'kɒn'trækt/ a contract for a company or person to do work for another company as part of a larger project.

sub-con-trac-tor /səb,'kɒn'træktə/ ▶ *n.* a business or person that carries out work for a company as part of a larger project.

sub-con-tra-ry /səb,'kɒntrəri/ ▶ *dated* Logic a contradictory proposition that can both be true and false, and both be false (e.g., some X are Y and some X are not Y). ▶ *n.* (pl. -ries) a proposition of this kind. ▶late 16th cent.: from late Latin *subcontrarius*, from *sub-* + *contrarius* *hypo-*.

sub-cort-ical /səb,'kɔːrtɪkəl/ ▶ *adj.* below the cortex. ■ Anatomy relating to or denoting the part of the brain below the cortex.

sub-cos-tal /səb,'kɒstl/ ▶ *adj.* Anatomy below a rib; below the ribs.

sub-crit-ical /səb,'krɪtɪkəl/ ▶ *adj.* Physics below a critical threshold, in particular: ■ (in nuclear physics) containing or involving less than the critical mass. ■ (of a flow of fluid) slower than the speed at which waves travel in the fluid.

sub-culture /səb,'kʌltʃər/ ▶ *n.* a cultural group within a larger culture, often having beliefs or values at variance with those of the larger culture. —*sub-cultural* /səb,'kʌltʃərəl/ *adj.*

sub-cu-ta-ne-ous /səb,'kyʊtə'neəs/ ▶ *adj.* Anatomy Medicine situated or applied under the skin, as subcutaneous fat. —*sub-cu-ta-neously* *adv.*

sub-dea-con /səb,'dekən/ ▶ *n.* (in some Christian churches) a minister of an order ranking below a deacon. Now largely obsolete in the West, although the liturgical role has been taken by other ministers. —*sub-di-a-con-ate* /səb,'dɪ'ækəntɪ/ *n.*

sub-di-rect-o-ry /səb,'dɪ'rektəri/ ▶ *n.* (pl. -ories) a directory below another directory in a hierarchy.

sub-di-vide /səb,'dɪvɪd/ ▶ *v.* [trans.] divide (something that has already been divided or that is being divided into units): the heading was subdivided into eight subheadings. ▶late Middle English: from Latin *subdividere* (see *SUB-*, *DIVIDE*).

sub-di-vi-sion /səb,'dɪvɪʒən/ ▶ *n.* the act of dividing or being subdivided. ■ a secondary or subordinate division. ■ an area of land divided into lots for sale; an area of housing. ■ Biology a taxonomic subcategory, esp. (in botany) one that ranks below division and above class.

sub-dom-inant /səb,'dɒmənənt/ ▶ *n.* Music the fifth note of the diatonic scale of any key.

sub-duc-tion /səb,'dʌkʃən/ ▶ *n.* Geology the upward and downward movement of the edge of a tectonic plate of the earth's crust into the mantle beneath another plate. ▶1970s: via French from Latin *subducere*, from *subducere* 'drawn from below, from beneath'.

sub-due /səb,'dʌ(y)ʊ/ ▶ *v.* (-dues, -dued) [trans.] overcome, quieten, or bring under control (a feeling or person): she managed to subdue her anger.

▶ *v.* (-dues, -dued) [trans.] bring (a country or people) under control by force: Charles went on a campaign to subdue the Welsh. ▶late Middle English: from Anglo-French *suduire*, from Latin *subducere* 'draw from below'. —*sub-du-a-ble* *adj.*

sub-dued /səb,'dʌ(y)ʊd/ ▶ *adj.* 1 (of a person) quiet and rather reflective.

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stutter-
subaltern

1028

stut-ter \ˈstət-ər\ *vb* : to speak or utter with involuntary repetition, disruption, or blocking of vocal sounds [Middle English *stutten*] SYN SEE STAMMER — **stut-ter-er** \ˈstət-ər-ər\ *n*

stutter *n* 1 : an act or instance of stuttering 2 : a speech disorder involving stuttering accompanied by emotional turmoil

sty \sti\ *n*, *pl sties also styes* \ˈstiz\ 1 : a pen or enclosed housing for swine 2 : a filthy, low, or vicious place [Old English *stig*]

sty or stye \sti\ *n*, *pl sties or styes* \ˈstiz\ : an inflamed swelling of a skin gland on the edge of an eyelid [from obsolete *styan*, from Old English *stigend*, from *stigan* "to rise"]

sty-glan \ˈstij-ən, ˈstij-ē-ən\ *adj*, often *cap* : INFERNAL, GLOOMY (*stygian* darkness) [Latin *stygus*, from Greek *stygios*, from *Styg-*, *Styx* "Styx"]

style \stil\ *n* 1 *a* : an instrument used by the ancients in writing on waxed tablets *b* : the shadow-producing indicator of a sundial *c* : GRAVER 2 *d* : NEEDLE 3 *e* : a slender prolongation of a plant ovary bearing a stigma at its apex *f* : a slender bodily process of an animal 2 : mode of expressing thought in language; *esp* : one characteristic of an individual, period, school, or nation (ornate *style*) 3 : the custom or plan followed in spelling, capitalization, punctuation, and typographic arrangement and display 4 : mode of address : TITLE 5 *a* (1) : manner or method of acting or performing especially in accordance with some standard (2) : a distinctive or characteristic manner *b* : a fashionable manner or mode (dining in *style*) (that dress is out of *style*) *c* : overall excellence, skill, or grace in performance, manner, or appearance [Latin *stilus* "stake, stylus, style of writing"] SYN SEE DICTION, FASHION — **style-less** \ˈstil-ləs\ *adj*

style vt 1 : NAME, CALL (*style* themselves scientists) 2 *a* : to cause to conform to a customary style *b* : to design and make in accord with the current fashion — **styl-er** *n*

style-book \ˈstil-bük\ *n* : a book explaining, describing, or illustrating the prevailing, accepted, or authorized style (a *stylebook* for printers)

sty-let \ˈsti-lət\ *n* 1 : a slender surgical probe 2 : a style on an animal [French, from Middle French *stilet* "stiletto", from Italian *stiletto*]

styl-ish \ˈsti-lish\ *adj* : having style; *esp* : conforming to current fashion — **styl-ish-ly** *adv* — **styl-ish-ness** *n*

styl-ist \ˈsti-ləst\ *n* 1 : a master or model of style; *esp* : a writer or speaker eminent in matters of style 2 : one who develops, designs, or advises on styles — **sty-lis-tic** \ˈsti-lis-tik\ *also* **sty-lis-ti-cal** \-ti-kəl\ *adj* — **sty-lis-ti-cal-ly** \-ti-kəl-ē, -klē\ *adv*

styl-ize \ˈstil-iz\ *vt* : to conform to a style; *esp* : to represent or design according to a style or stylistic pattern rather than according to nature — **styl-iza-tion** \ˈsti-lə-ˈzā-shən\ *n* — **styl-iz-er** \ˈstil-ī-zər\ *n*

styl-lo-bate \ˈsti-lə-bāt\ *n* : a continuous flat coping or pavement on which a row of architectural columns is supported [Latin *stylobates*, from Greek *stylobatēs*, from *stylos* "pillar" + *bainein* "to walk, go"]

styl-loid \ˈstil-oid\ *adj* : resembling a style (the slender pointed *stylold* process of the ulna)

sty-lus \ˈsti-ləs\ *n*, *pl sty-lil* \ˈstil-ī\ *also* **sty-lus-es** \ˈsti-lə-səz\ 1 : an instrument for writing or marking 2 : NEEDLE 3d [Latin *stilus* "stake, stylus"]

sty-mie \ˈsti-mē\ *n* : a very distressing and thwarting situation [perhaps from Scottish *stymie* "person with poor eyesight"]

stymie vt *sty-mied*; **sty-mie-ing** : to present an obstacle to : stand in the way of

styp-tic \ˈstip-tik\ *adj* : tending to contract or bind : AS-TRINGENT; *esp* : tending to check bleeding (*stypitic* effect of cold) [Latin *stypiticus*, from Greek *styptikos*, from *styphein* "to contract"] — **styp-tic** *n*

styp-tic pencil *n* : a cylindrical stick of medicated *stypic* substance used especially in shaving to stop the bleeding from small cuts

sty-rene \ˈsti-rēn\ *n* : a fragrant liquid hydrocarbon used chiefly in making synthetic rubber, resins, and plastics [derived from Latin *styrax* "storax"]

Sty-ro-foam \ˈsti-rə-fōm\ *trademark* — used for an expanded rigid polystyrene plastic

sua-sion \ˈswā-zhən\ *n* : the act of influencing or persuading [Latin *suasio*, from *suadere* "to urge, persuade"] — **sua-sive** \ˈswā-siv-, -ziv\ *adj* — **sua-sive-ly** *adv* — **sua-sive-ness** *n*

suave \ˈswāv\ *adj* : smoothly but often superficially polite and agreeable [Middle French, "pleasant, sweet", from Latin *suavis*] — **suave-ly** *adv* — **suave-ness** *n* — **sua-vi-ty** \ˈswāv-ət-ē\ *n* □ SYN SUAVE, URBANE, BLAND, SMOOTH mean pleasingly tactful and well-mannered. SUAVE implies a specific ability to deal with others easily and without friction (a *suave* headwaiter) URBANE suggests courtesy and poise developed by wide social experience (an *urbane* outlook on life) BLAND emphasizes mildness of manner and absence of irritating qualities (a *bland*, kindly old soul) SMOOTH usually suggests a deliberately assumed suavity (a *smooth* liar)

sub \səb\ *n* : SUBSTITUTE

sub vt *subbed*; **sub-bing** : to act as a substitute

sub *n* : SUBMARINE

sub- prefix 1 : under : beneath : below (*subaqueous*) (*subsoil*) 2 *a* : subordinate : secondary (*substation*) *b* : subdivision of (*subcommittee*) (*subspecies*) *c* : with repetition (as of a process) so as to form, stress, or deal with subordinate parts or relations (*sublet*) 3 : less than completely, perfectly, or normally : somewhat (*subdominant*) 4 : falling nearly in the category of and often adjoining : bordering upon (*subarctic*) [Latin, "under, below, secretly, from below, up, near", from *sub* "under, close to"]

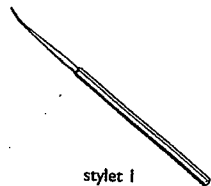
See *sub-* and 2d element

subadolescent	subdialect	subparagraph
subagency	subdirector	subpart
subagent	subdiscipline	subproblem
suballocation	subdistrict	subprocess
subaverage	subfield	subproduct
subbase	subfile	subprogram
subbasement	subframe	subproject
subbranch	subgenre	subregion
subcabinet	subglacial	subroutine
subcaste	subgoal	subsea
subcategorization	subgroup	subsite
subcategorize	subhumid	subsociety
subcategory	subindustry	subspecialty
subclassification	sublethal	subsystem
subclassify	sublevel	subtask
subcluster	sublot	subtest
subcollege	submarket	subtheme
subcollegiate	subminimal	subtotal
subcolony	subnetwork	subtreasury
subcommission	subniche	subtribe
subcommunity	suboceanic	subtype
subcomponent	suboptimal	subunit
subcult	suborganization	subvisible
subdepartment	subpar	subzone
subdevelopment		

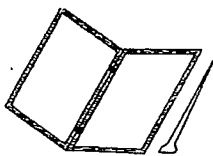
sub-aer-i-al \səb-ˈar-ē-əl, ˈsəb-, ˈer-, səb-ā-ˈir-ē-əl\ *adj* : situated or occurring on or close to the surface of the earth (*subaerial* habitat) (*subaerial* roots) — **aer-i-al-ly** \-ē-ə-lē\ *adv*

sub-al-pine \səb-ˈal-pīn, ˈsəb-\ *adj* 1 : of or relating to the region about the foot and lower slopes of the Alps 2 *cap* : of, relating to, or growing on upland slopes near timberline

sub-al-tern \sə-ˈbōl-tərn, especially British ˈsɒl-tərn\ *adj* : of low or lower rank : SUBORDINATE [Latin *subalternus*, from Latin *sub-* + *alternus* "alternate"]



stylus 1



stylus 1 with Roman wax tablet

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THE JOURNAL OF
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AMERICAN VOLUME

ORIGINAL COMMUNICATIONS

Anatomy of the finger flexor tendon sheath and pulley system

Additions and changes in the description of the anatomy of the finger flexor sheath and pulleys that I published in 1974 and 1975 have prompted me to restudy this system. Sixty-one fresh human cadaver fingers were dissected using the operating room microscope. This study demonstrated a flexor synovial sheath composed of visceral and parietal elements from the neck of the metacarpal to the distal interphalangeal joint, which was overlaid with a series of retinacular structures (pulleys). The pulleys identified were the palmar aponeurosis pulley, five annular pulleys, and three cruciform pulleys. Although significant variations were noted in the morphology of the first annular and the cruciform pulleys sufficient similarity exists between my first description and the present study to support the use of the original descriptive terminology. A significant addition to the pulley system is the palmar aponeurosis pulley described by Manske and Lesker. (J HAND SURG 1988;13A:473-84.)

James R. Doyle, MD, Honolulu, Hawaii

Recent descriptions¹⁻⁹ of the finger flexor tendon sheath and pulley system since my original description in 1974 and 1975^{10, 11} have prompted a re-evaluation of the anatomy of the system.

Methods

Sixty-one fingers of fresh human cadavers were dissected and studied using the operating room microscope. The sheath was injected with a diluted solution of methylene blue, which provided good visual contrast

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No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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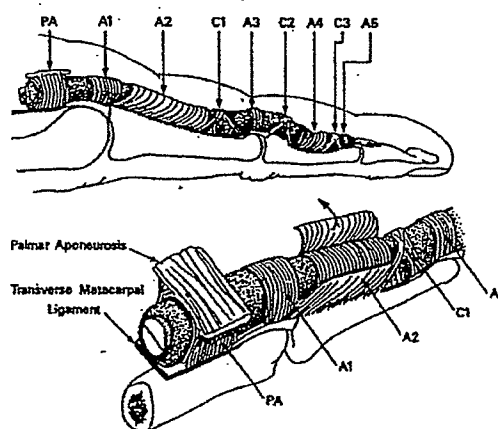


Fig. 1. Composite depiction of the flexor tendon synovial sheath and pulleys including the palmar aponeurosis pulley, five annular pulleys, and three cruciform pulleys.

Table I. Finger pulleys: Incidence, width and configuration

Finger	PA	A1			A2	A1/A2*	C1		
		1 Part	2 Part	3 Part			Cruciate	Single	"Y"
Index (14 Digits)									
Incidence	14	10	2	0	12	2	10	3	1
Average width	7.4	9.2	12.4		15.9	28.0	4.2	3.2	2.7
Minimum (mm)	3.5	3.2	10.1		11.4	26.3	1.8	1.5	2.7
Maximum (mm)	16.6	13.2	14.7		23.3	29.6	7.0	6.3	2.7
STD Deviation	3.4	3.5	2.3		4.0	1.6	1.6	2.2	
Long (16 Digits)									
Incidence	16	12	4	0	16	0	14	1	1
Average width	10.3	9.4	12.2		20.5		5.1	1.7	4.9
Minimum (mm)	4.9	5.3	10.0		15.6		2.1	1.7	4.9
Maximum (mm)	20.1	15.3	15.3		25.3		9.6	1.7	4.9
STD Deviation	3.4	3.2	1.9		3.2		2.1		0.0
Ring (16 Digits)									
Incidence	16	9	4	2	15	1	14	1	1
Average width	11.4	7.5	9.0	9.2	18.9	32.4	3.9	5.1	3.5
Minimum (mm)	5.0	5.7	6.6	8.8	15.4	32.4	2.0	5.1	3.5
Maximum (mm)	18.7	12.4	10.9	9.5	25.5	32.4	6.7	5.1	3.5
STD Deviation	3.2	2.0	1.5	0.4	2.9	0.0	1.5	0.0	0.0
Small (15 Digits)									
Incidence	15	5	4	6	15	0	13	0	2
Average width	8.1	5.3	11.7	11.8	11.7		3.8		5.0
Minimum (mm)	2.9	4.2	7.0	8.3	8.2		1.9		3.8
Maximum (mm)	14.7	7.0	15.8	14.8	19.3		5.2		6.1
STD Deviation	2.9	0.9	3.8	2.3	3.4		1.0		1.1

*A1/A2. No separation was noted between A1 and A2 in three fingers (see text)

between the synovial sheath and the retinacular (pulley) system. Minimum injection pressure was used, since the distal end of the sheath could easily be ruptured with excessive pressure. The findings of these dissections were compared with serial longitudinal sections of whole fingers embedded in nitrocellulose¹² and stained with hematoxylin and eosin. The width of the pulleys was measured at their most palmar aspect by a fine point micrometer and the measurements were rounded to the nearest tenth of a millimeter (Table I).

Findings

The flexor tendon sheath is composed of synovial and retinacular tissue components, which have separate and distinct functions. The *membranous* portion is a synovial tube sealed at both ends. The *retinacular* (pulley) portion is a series of transverse, annular, and cruciform fibrous tissue condensations, which overlay the synovial portion of the sheath (Fig. 1). The floor or dorsal aspect of this tunnel is composed of the deep transverse metacarpal ligament, the palmar plates of the metacarpophalangeal (MP), the proximal interphalan-

geal (PIP), and distal interphalangeal (DIP) joints and the palmar surfaces of the proximal and middle phalanges. In the index, long, and ring fingers the membranous portion of the sheath begins at the neck of the metacarpals and continues distally to end at the distal interphalangeal joint. In most instances the small finger synovial sheath continues proximally to the wrist; this is consistent with the findings of others.^{13, 14} Visceral and parietal synovial layers were identified, which agree with recent and earlier studies.^{6, 10, 11, 15-17} A prominent synovial pouch is noted proximally and represents the confluence of the visceral and parietal layers. A visceral layer reflection or pouch is also noted between the two flexors at the neck of the metacarpal but is 4 to 5 mm distal to the more visible proximal and external portions of the synovial sheath. In no instance did the synovial sheath extend beyond the DIP (Fig. 2, A to C). The membranous or synovial portions of the sheath are most noticeable in the spaces between the pulleys where they form plicae and pouches to accommodate flexion and extension (Fig. 3, A to C).

The *retinacular* (pulley) portion of the sheath is char-

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	A3	C2			A4	C3			A5
		Cruciate	Single	"Y"		Cruciate	Single	"Y"	
13	6	5	1	13	7	4	0	13	
2.8	2.4	1.8	5.6	6.1	2.2	2.4		3.9	
1.1	0.7	0.4	5.6	5.0	1.4	1.0		2.0	
4.7	5.6	3.7	5.6	9.7	4.1	3.1		6.3	
1.1	1.8	1.1		1.3	0.8	0.8		1.5	
14	6	6	0	16	6	5	3	15	
2.7	2.7	3.1		7.7	2.6	2.3	3.0	4.3	
1.8	1.3	1.0		5.3	0.8	1.6	2.6	1.8	
5.0	4.9	6.1		10.6	5.9	3.1	3.3	7.9	
0.9	1.4	1.8		1.8	1.7	0.6	0.3	1.8	
13	6	4	1	16	12	0	0	15	
2.9	3.7	1.6	2.2	7.0	3.0			3.9	
0.9	2.0	0.9	2.2	5.5	1.5			1.9	
3.9	5.4	2.5	2.2	11.9	4.8			6.3	
0.9	1.0	0.6		1.5	1.1			1.4	
13	5	4	0	15	7	4	0	14	
2.7	2.6	2.0		5.9	2.4	1.4		4.3	
1.2	1.7	1.5		4.2	1.6	1.3		1.3	
5.1	3.8	2.7		13.0	3.4	1.5		7.2	
1.1	0.8	0.4		2.1	0.6	0.1		1.8	

acterized by fibrous tissue bands of transverse, annular, and cruciform configuration that overlay the synovial sheath in a segmental fashion and maintain the flexor tendons in a constant relationship to the joint axis of motion. The cruciform fibers are sometimes single oblique limbs or Y-shaped. Pulleys, by my definition, are fibrous tissue bands of variable width, thickness, and configuration that overlay the synovial sheath. The following pulleys have been identified: the palmar aponeurosis pulley, five annular pulleys, and three cruciform pulleys (Fig. 1 and Table I).

The palmar aponeurosis pulley is formed from the transverse fibers of the palmar aponeurosis.^{5, 18} The average width is 9.3 mm and its proximal edge is located 1 to 3 mm distal to the beginning of the membranous sheath (Fig. 2, B). It is anchored on each side of the sheath by vertical fibers or septa that attach to the deep transverse metacarpal ligament (Fig. 4, A to B). This pulley is widest over the long and ring fingers (Table I). The palmar aponeurosis pulley is not as closely applied to the tendons as the other pulleys at least in the static state (Fig. 2, A). Closer approximation may

occur with increased tension on the palmar aponeurosis as in grasping. This proximal tension is provided by either the palmaris longus or the flexor carpi ulnaris or both.^{18, 19} Static traction forces applied to the palmaris longus tendon produced depression of the longitudinal fibers of the aponeurosis and tightening of the transverse palmar ligament.

The first of the five annular pulleys begins in the region of the palmar plate of the MP joint. The majority of fibers (about two thirds) arise from the palmar plate, with the remainder arising from the proximal portion of the proximal phalanx (Fig. 1). Although the most usual configuration of the A1 pulley was a single annular pulley (59%); which averaged 7.9 mm in width, it was sometimes represented by two or three annular bands (Fig. 5, A to B and Table I). A distinct separation between the A1 and A2 pulleys was found in 58 (95%) of the 61 fingers studied. This separation ranged from 0.4 mm to 4.1 mm and was most wide on the palmar aspect. In the three cases that did not have a distinct separation there was a pronounced thinness to the retinacular tissue for a distance of several millimeters

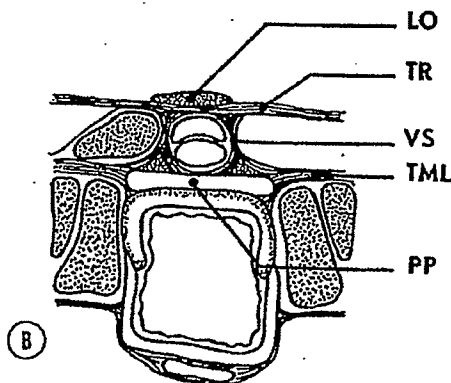
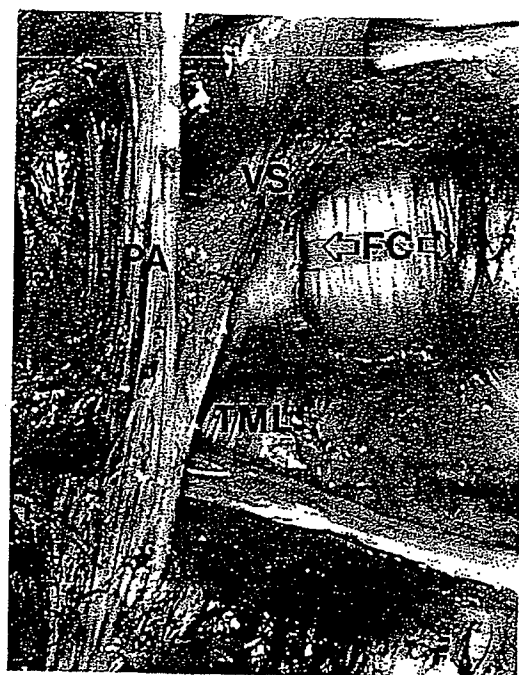


Fig. 4. A, Gross dissection of the palmar aponeurosis pulley complex showing the transverse fibers of the palmar aponeurosis (PA), the vertical septa (VS) forming the vertical walls of the flexor canal (FC) and anchoring the transverse fibers of the palmar aponeurosis to the transverse metacarpal ligament (TML) and the palmar plate. B, Cross-section drawing at the MP joint level showing the longitudinal (LO) and transverse (TR) fibers of the palmar aponeurosis, the attachment by vertical septa (VS) of the transverse fibers of the palmar aponeurosis to the underlying palmar plate (VP) and transverse metacarpal ligament (TML). Redrawn from Bojsen-Moller F, Schmidt L. *J Anat* 1974;117:55-68. Reprinted with the permission of Cambridge University Press.

at the usual site of separation. This allowed for flexion at the MP joint without deformation of the pulley complex. In addition to the finding of thinness at the conjoined interface of the A1 and A2 pulleys, two of the three specimens that did not demonstrate a distinct separation between the A1 and A2 pulleys had large triangular-shaped openings laterally, which allowed for flexion of the retinacular complex without buckling or impingement.

In contrast to the variability in configurations of the A1 pulley the proximal edge of the second annular pulley was constant in shape, with oblique fibers of origin beginning at the proximal and lateral base of the proximal phalanx, which joined annular fibers to make a prominent and thick leading edge (Fig. 5, B). Synovial outpouching was common in the space between the A1 and A2 pulleys (Fig. 3, A to B). The A2 pulley was 16.8 mm in average width and was thickest in the distal end (Fig. 3, B). The deeper annular fibers of the A2 pulley were overlaid with oblique fibers, which at the distal end interdigitated to form the first cruciform pulley (Figs. 1 and 6).

The third annular pulley (A3) is located at the PIP joint and attaches to the palmar plate. The A3 pulley was present in 87% of the specimens and the average width was 2.8 mm (Fig. 7 and Table I).

The fourth annular pulley (A4), located in the middle phalanx was present in 60 (98%) of 61 digits. The fourth annular pulley is overlaid with oblique fibers that form a cruciform pulley, C3, at the distal end. The A4 pulley was 6.7 mm in average length and thickest in its midaspect (Fig. 8, A to B).

The fifth annular pulley (A5) was present in 93% of the specimens. It was quite thin, 4.1 mm in average length, and it was attached to the underlying palmar plate (Fig. 8, A and Fig. 9). The sheath was noted to end at the level of the DIP joint, and no pulleys were identified beyond the distal joint (Fig. 2, C and Fig. 9).

There were three cruciform pulleys that were located at the distal ends of the A2 and A4 pulleys and in the space between the A3 and A4 pulleys. Variation in the shape was common—some were represented by a single oblique limb (Fig. 10) or a Y-shape (ypsiloform). The third cruciform pulley at the distal end of the A4 pulley was often noted to be formed by prominent extensions of oblique fibers overlying the A4 pulley and was not always a separate structure (Fig. 8, A). The incidence and configuration of the various cruciate pulleys is given in Table I. In addition to the anatomic variations previously described in the cruciform and first annular pulleys, other single variations were also noted:

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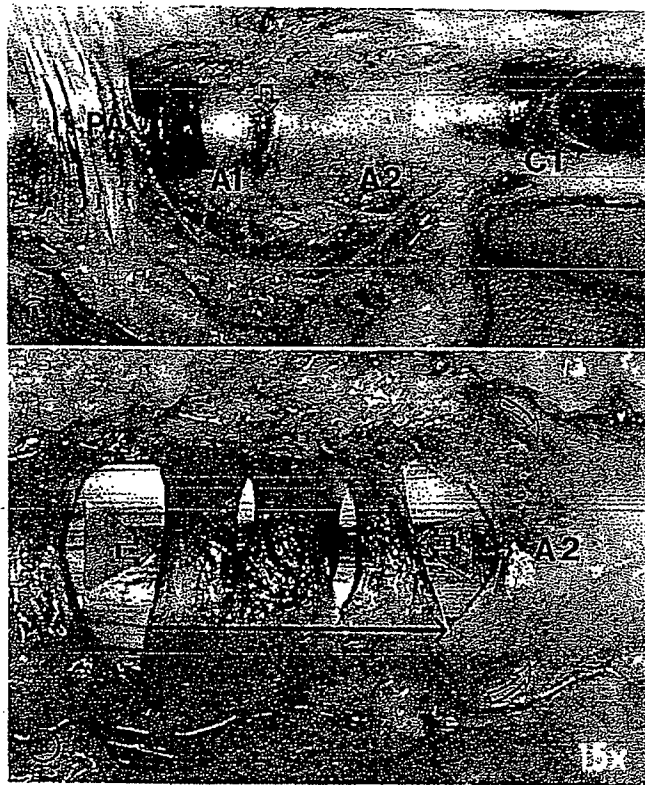


Fig. 5. A, Composite view from the palmar aponeurosis pulley to C1 pulley showing separation of the A1 and A2 pulleys (vertical arrow) and the usual arrangement and configuration of these pulleys. B, A three-part A1 pulley with the synovial membrane removed for clarity. Note also the oblique fibers of origin of the A2 pulley (curved arrows), which was a consistent finding and made it possible to distinguish the A2 pulley from the A1 pulley whose fibers were always annular rather than oblique.

(1) a two-part A3 pulley, (2) a Y-shaped A5 pulley, (3) a two-part A5 pulley, (4) an accessory cruciform pulley between C1 and A3, and (5) a cruciate rather than annular-shaped pulley (in three digits of the same hand) over the PIP joint in the position usually occupied by A3 pulley.

In the zone between the A3 and A4 pulleys casual observation occasionally suggested the presence of annular-shaped pulleys, but further dissection and scrutiny revealed either a broad single oblique pulley or a cruciform-type pulley, with comparatively wide lateral margins but with a more narrow interdigitating palmar aspect.

The pertinent vital statistics of the pulleys are summarized in Table I.

Discussion

The retinacular (pulley) system. Manske and Lesker⁵ in 1983 described the functional anatomy of the transverse fibers of the palmar aponeurosis and noted that this structure acted as a pulley. They noted that the transverse fasciculi are a band of fibers approximately 1 cm wide that overlay the proximal tendon sheath and are anchored to the deep palmar interosseous fascia* by thick fibrous bands on each side of the tendons. These fibers were designated as the palmar aponeurosis pulley (PA pulley). Baseline total range of motion (TRM) was determined for each finger in 12

*I believe that these fibers should be called the deep transverse metacarpal ligament rather than the deep palmar interosseous fascia (see Reference 18).

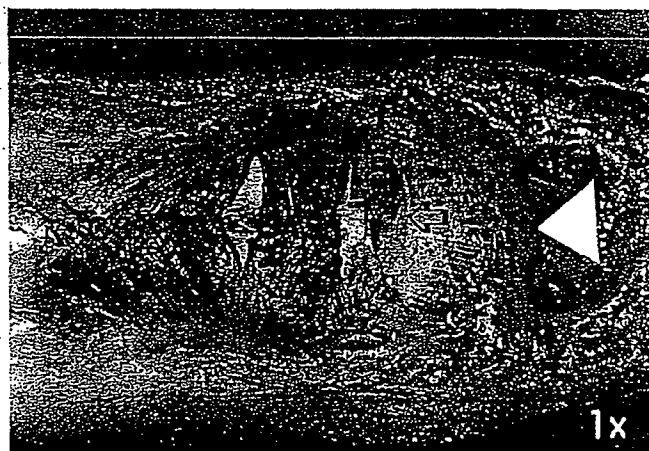


Fig. 9. The fifth annular pulley and its relationship to the C3 pulley and the end of the synovial sheath marked by the horizontal arrow. Note that the flexor tendon continues well beyond the end of the sheath. The apex of the white triangle marker points to the ungual pouch fascia and the distal most aspect of insertion of the profundus tendon.

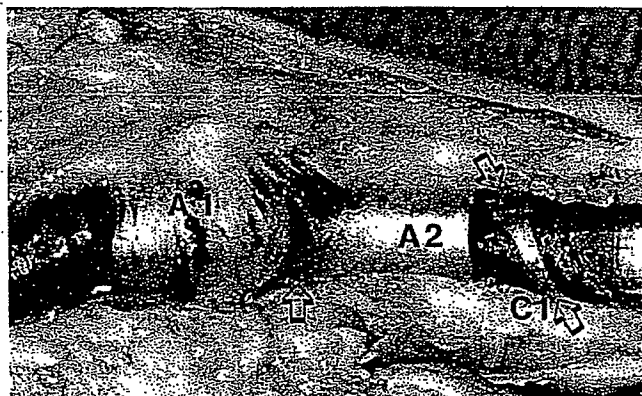


Fig. 10. Note the single oblique configuration of the C1 pulley, the wide A1 pulley with synovial outpouching in its midaspect, and the triangular separation (vertical arrow) between the A1 and A2 pulleys.

additional annular pulley distal to the A5 pulley at the base of the distal phalanx, but I was not able to identify any pulleys in this area. The sheath clearly ends at the distal joint just beyond the A5 pulley (Fig. 2, C and Fig. 9). I believe that the pulley-like structures described by Strauch and de Moura distal to annular five are elements of the digital fascia described by Shrewsbury and Johnson.²⁸ This conclusion agrees with my concept that pulleys by definition are fibrous tissue structures that overlay the synovial sheath.

Significant flexion in the finger is achieved without buckling of the retinacular system or impingement on the underlying tendon(s) due to the fact that: (1) the broader pulleys, A2 and A4, are located between joints, whereas the more narrow pulleys, A1 and A3, are over the joints; (2) the pulleys are arranged in a segmental fashion with synovial pouches and windows between; (3) the thinner and more narrow cruciform pulleys are located near joints where they can more easily accommodate to the confined space in acute flexion. The func-

tional adaptation of the retinacular system to the requirements of flexion is also apparent in the region of the MP joint where some anatomic accommodation is always present between A1 and A2, either in the form of definite separation between A1 and A2 (95% of cases in this study), thinning of the contiguous margins of A1 and A2, or triangular-shaped openings in the lateral margins of the retinaculum so that flexion can occur without buckling (Fig. 3, A). Furthermore, compressibility of the various pulleys has been reported and may also be a factor in accommodating joint motion without buckling and impingement.²⁹

The membranous (synovial) system. Bunnell¹⁷ noted that a tendon sheath was an adaptation that allowed a tendon to turn a corner. Bunnell stated, "It glides around a curve on a thin film of synovial fluid between two smooth synovial lined surfaces, just as metal surfaces in machinery glide on a thin film of oil."¹⁷ Bunnell further noted that a tendon sheath had two layers of synovia, a visceral one investing the tendon, and a parietal layer lining the fascial (retinacular) tunnel through which the tendon glided. Lundborg and Myrthage²⁶ noted a well-vascularized membrane with plicae and pouches at the margins of the pulleys that were important for flexion and stretching of the sheath. They were not able to demonstrate any continuity of the synovial cell layer on the friction surface of the A2 pulley. Chondrocyte-like cells were observed in the superficial layers of this pulley. Knott and Schmidt²³ also observed cartilage-like tissue at the distal end of the A2 pulley. In certain avascular areas of the palmar portion of the tendons visceral synovial tissues were absent on histologic sections. Furthermore, in some scattered areas of the palmar surface of the tendon there were areas with cartilaginous differentiation similar to the findings in the A2 pulley. Lundborg and Myrthage concluded that the friction surface of the pulleys is devoid of vessels and that the friction and gliding in the digital sheath system takes place between two avascular structures, namely the palmar aspect of the flexor tendons and the inner aspect of the pulleys. These avascular gliding surfaces are nourished by diffusion from the synovial fluid. Histologic studies by Lundborg and Myrthage demonstrated that the vascular plexus of the synovial sheath is in continuity on the *outside* of the rigid pulleys and by this arrangement the pulleys meet the mechanical forces associated with finger flexion and the synovial membrane avoids compression and friction force. Therefore, the microcirculation is not compromised. The authors²⁶ further noted that synovial fluid acts as a lubricating agent, as well as the agent for diffusion to the avascular friction surfaces of the tendon and pulleys.

The findings of Lundborg and Myrthage are appropriately compared with the findings of Cohen and Kaplan,¹⁵ who in a recent study of the gross, microscopic, and ultrastructure (electron microscopy) of the flexor tendon sheath, noted that the sheath consists of a *noninterrupted* layer of parietal synovium reinforced externally at intervals by dense bands of collagen (the retinacular system). Cohen and Kaplan further noted that the contents of the sheath were independently covered by a second similar layer of visceral synovium and that the two layers were continuous at the proximal cul-de-sac, the vincula origins, and the tendon insertions. The synovial cells lining the pulley and covering the tendons were quantitatively, but not morphologically, different from the synovial cells of the membranous (synovial) portion of the sheath. The thickness of the synovial layers was greatest at the spaces between the pulleys and thin or attenuated beneath the annular pulleys and on tendon surfaces distant from vincula and cul-de-sacs.

Conclusions

My current understanding of the flexor tendon sheath is depicted in Fig. 1. The *retinacular* portion overlays the membranous or synovial portion and consists of the palmar aponeurosis pulley, five annular pulleys, and three cruciform pulleys. The various configurations and segmental arrangement of the retinacular (pulley) system permits flexion of the digit without buckling of the pulleys or impingement on the underlying tendon(s). In the index, long, and ring fingers the *membranous* or synovial portion of the sheath begins in the region of the metacarpal neck and ends at the DIP joint. This membranous sheath is a synovial tube with visceral and parietal layers with a prominent proximal cul-de-sac. The parietal synovium layer is continuous although it is attenuated over the major friction surfaces, such as the distal end of annular 2. The rich vascular supply to the parietal synovium is most noticeable in the spaces between the fibrous pulleys. This vascular network passes on the *outside* of the pulleys, which avoids their friction surfaces and thereby maintains its continuity and integrity. The well-vascularized synovial elements of the sheath represent a dialysing membrane that produced a plasma filtrate, the synovial fluid, which acts as a lubricating agent and also as a nutritional factor for the retinacular system and tendon.^{26, 30}

Although numerous variations were noted in the morphology of the first annular and the cruciform pulleys sufficient similarity exists between my original description^{10, 11} and the present study to support continued use of my original descriptive terminology. A significant addition to the description of the pulley sys-

tem is the palmar aponeurosis pulley described by Manske and Lesker.⁵

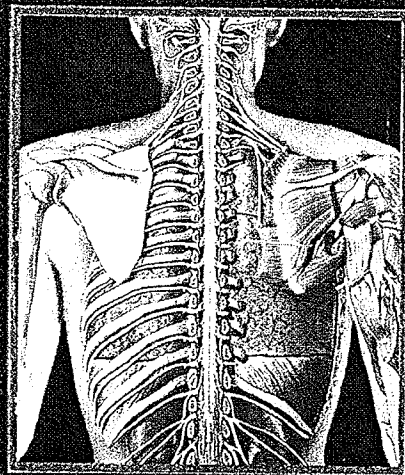
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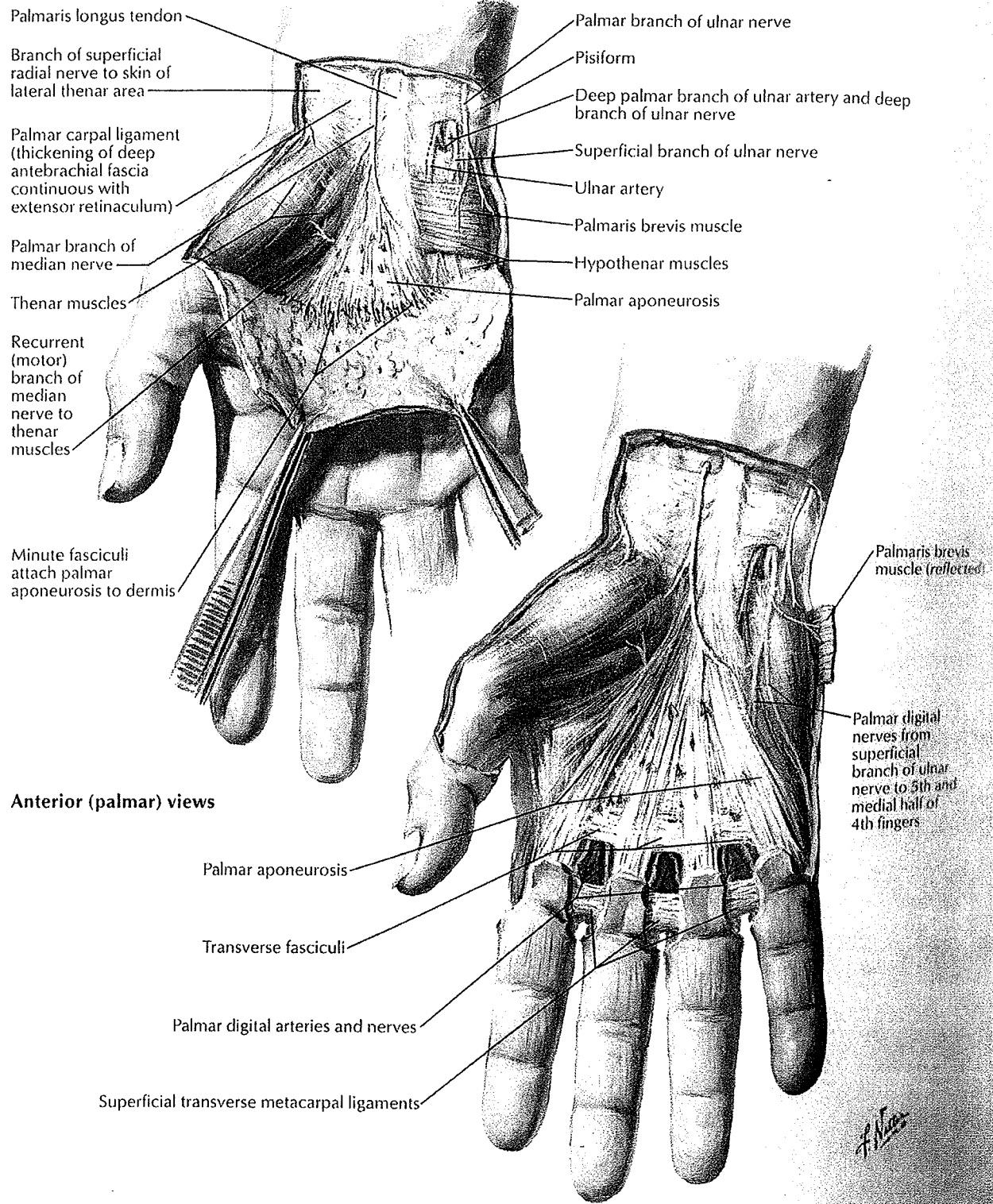
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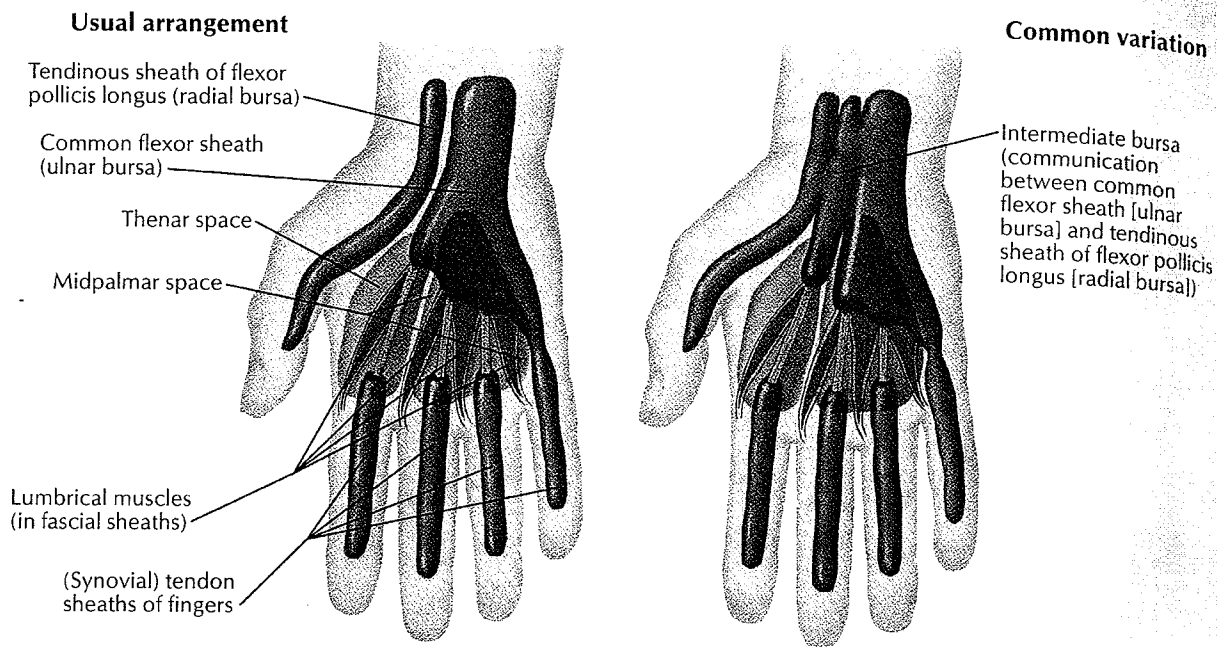
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